THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[REGISTERED AS A NEWSPAPER.]

VOL. XXVII. No. 682.] LONDON, JUNE 6, 1876. [28TH YEAR.] Price 6d.

RAMSAY'S NEWCASTLE CANNEL COAL. Analysis—12,000 cubic feet of gas per ton of coal; 28-candle gas; coke 66·70 per cent.; volatile matters 33·30 per cent. Coke of good quality.

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GENUINE TORBAY PAINT
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SPECIAL GASOMETER PAINT
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These Paints are now used in 100 Country Gas-Works, and by all (but one) of the London Gas Companies, on Gasholders, Scrubbers, Purifiers, &c. They will cover tar effectually. Also used by the Admiralty, War Office, Railway Companies, Founders, &c.

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Were the only parties to whom a PRIZE MEDAL was awarded at the GREAT EXHIBITION of 1851, for "GAS-RETORTS and OTHER OBJECTS in FIRE-CLAY," and they were also awarded at the INTERNATIONAL EXHIBITION of 1862, the PRIZE MEDAL for "GAS-RETORTS, FIRE-BRICKS, &c., for EXCELLENCE of QUALITY."

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Established at the commencement of Gas Lighting.
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And Gas Apparatus of every Description.
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FOR THE ENGLISH GOVERNMENT
AND FOR THE GOVERNMENT OF THE NETHERLANDS
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Presented by Her Majesty's Government to the French Government,
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Warranted to Measure correctly & not to vary.

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CHANDELIERS, &c., GAS-FITTERS' TOOLS, GAS TONGS, STOCKS, TAPS, DIES, &c., &c.,
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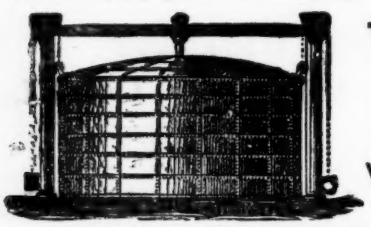

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WROUGHT AND CAST IRON SCRUBBERS, PURIFIERS
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ARE NOW PREPARED TO SUPPLY AND ERECT THEIR PATENTED MACHINERY FOR

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And to enter into arrangements with GAS COMPANIES for its use upon moderate terms of Royalty.

The Patented Machinery has secured the approbation of all Engineers who have visited the MAIDSTONE GAS-WORKS, *where it is in full operation, and may be inspected at any time on application to the Manager.*

The advantages attending its use are—

INCREASED VOLUME OF GAS PER TON.—INCREASED YIELD PER RETORT.—INCREASED BULK OF COKE FOR SALE.—REDUCTION IN LABOUR AND LESS DEPENDENCE ON SKILLED STOKERS.

A Pamphlet containing a description of the Machinery, and Copies of Reports on the working of the same, &c., will be forwarded on application to the MANAGING DIRECTOR, Maidstone. Communications may also be addressed to the Consulting Engineer, R. P. SPICE, Esq., M. Inst. C.E., 21, Parliament Street, London, S.W., or to the Engineer and Analyst, F. W. HARTLEY, Esq., A. Inst. C.E., 55, Millbank Street, London, S.W.

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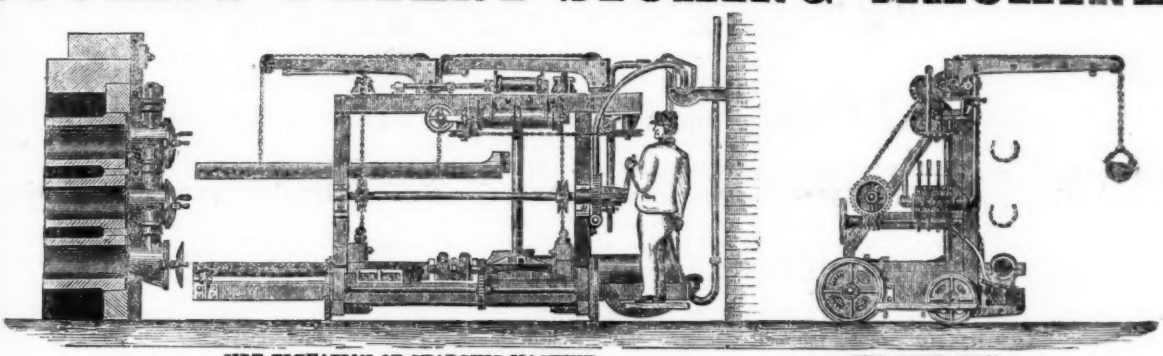

SIDE ELEVATION OF CHARGING MACHINE. END ELEVATION

(*The Drawing Machine will be Illustrated in next week's Advertisement.*)

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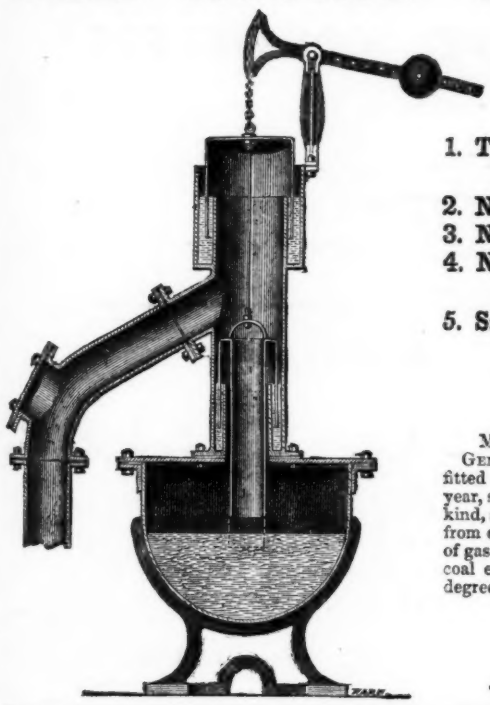

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ADVANTAGES.

1. There is no pressure on the Retorts.
2. No deposit of Carbon.
3. No scurfing is required.
4. Never a choked Ascension-Pipe.
5. Saves Fuel and Wear and Tear.
6. Gets 10 per cent. more Gas out of the Coal, and a higher Illuminating Power.
7. Is never out of order.
8. Requires no attention.
9. Is perfectly automatic in its action.

TESTIMONIAL.

Tenby Gas-Works, March 29, 1876.

MESSRS. CHANDLER AND STEVENSON.

GENTLEMEN,—In reply to your inquiry, I have to say that all the retorts at these works are fitted with your Self-Acting Patent Dip-Pipes. They have been in use now for more than a year, some for more than two years. They have never required repair or attention of any kind, and work admirably. By the use of these removable dips the retorts are kept quite free from carbon, the charges burn off more quickly than before they were adopted, and the yield of gas is increased. We get regularly a weekly and monthly average yield of gas per ton of coal exceeding 10,400 feet of 14-candle gas, and I attribute this excellent result in no small degree to the use of these Self-Acting Removable Dip-Pipes.

I am, gentlemen, yours faithfully,

(Signed) EDMUND H. STEVENSON.

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ERECTION OF GAS OR WATER WORKS;

CONTRACTORS FOR PIPE-LAYING AND GAS-FITTING.

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KING'S ROAD, LONDON, N.W.,

OFFICE: 115, VICTORIA STREET, WESTMINSTER, S.W.,

MANUFACTURERS OF

"WET" & "DRY" GAS-METERS IN IRON & TIN-PLATE CASES,

STATION-METERS AND GOVERNORS, STREET-LAMP METERS, BOXES, AND REGULATORS FOR THE AVERAGE METER SYSTEM.

TO GAS COMPANIES, ENGINEERS, &c.

These Works are in full operation, and it will be the aim of the New Company not only to keep up the excellent workmanship of their predecessors, but, by the introduction of special machinery, to manufacture **Meters of a higher standard than is usually given, without increasing the cost.**

Special attention is invited to the Compensating Wet Gas-Meter of De Castro and Burton, which is now becoming so generally adopted, and is more simple in construction than any other Compensating or Ordinary Wet Meter. There is but one centre of friction to be overcome by the gas. By its self-adjusting principle it maintains an unvarying water-line; and the reservoir contains sufficient water to supply the Meter for twelve months without attention. It is unaffected by "tilting," and cannot be "flooded" by any pressure.

The Company also manufacture Dry Meters upon the most improved principle, and all their Meters being made to standard gauges, the most accurate measurement is obtained.

Attention is also called to their Dry Meters in Wood Cases, as used by some of the London Gas Companies. These Cases are a great preservation to Tin-plate Meters, especially in seaport towns, where the air is impregnated with salt; they are also particularly suited for export.

The Company repair or convert every description of Wet Gas-Meters to De Castro and Burton's Patent.

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GARRATT STREET WORKS, OLDHAM ROAD, MANCHESTER;

Manufacturers of

IMPROVED CONSUMERS WET GAS-METERS

IN CAST-IRON CASES,

THE UNVARYING WATER-LINE GAS-METER,

AND

IMPROVED DRY GAS-METERS;

STATION-METERS OF ALL SIZES, with PLANED JOINTS;

GOVERNORS, PRESSURE AND EXHAUST REGISTERS, TEST HOLDERS.

And all kinds of Experimental Gas Apparatus.

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EVERY DESCRIPTION OF GAS APPARATUS.

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NEW GAS-WORKS erected complete. Plans and Estimates furnished. MAINS, METERS, SERVICES, LAMPS, &c., adapted for Towns of any size. Gas Companies advised on Improvements, Extensions, and Alterations of Works.

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RETORTS and RETORT-HOUSE FITTINGS, CONDENSERS, SCRUBBERS, ENGINES and EXHAUSTERS, PURIFIERS, STATION-METERS, GOVERNORS, VALVES, &c.

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They beg special attention to the excellence and superiority of their WET and DRY METERS, several thousand being now in use by many of the largest Gas Companies in the West of England and South Wales. Warranted to measure correctly, and not to vary. Their acknowledged superiority has brought them into general use more rapidly than any Meters hitherto manufactured. A guarantee of Five years tendered with each Meter.

GAS-FITTING DEPARTMENT.

An extensive variety of Choice Designs in CHANDELIERS, PENDANTS, BRACKETS, STAR and SUN LIGHTS, MEDIÆVAL FITTINGS for CHURCHES, &c.

PATTERN-BOOKS and PRICE LISTS furnished.

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GAS ENGINEERING WORKS, COMMERCIAL ROAD, EXETER.

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GAS ENGINEER,

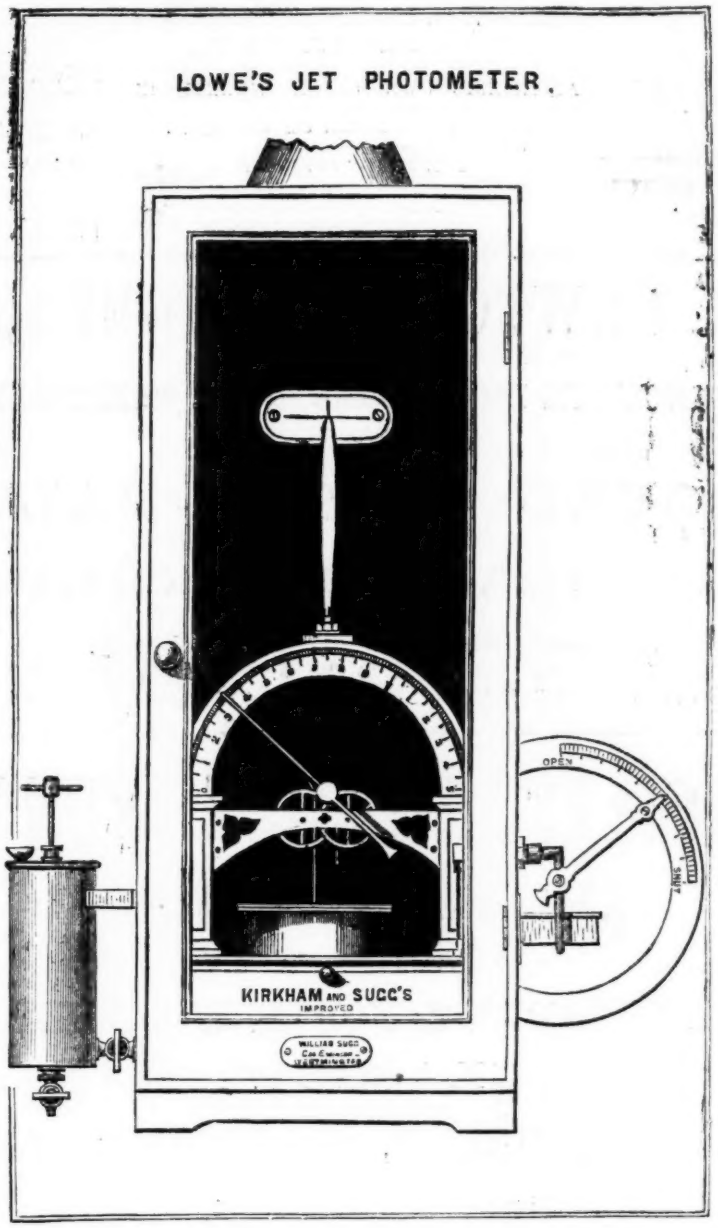
VINCENT WORKS, VINCENT STREET,

WESTMINSTER, S.W.

"EVANS"

Photometers,

which do not require a Dark Room, with every Fitting accurately made to Gauge, French Polished Bench and Drawers complete, as approved by the Gas Referees.



"LETHEBY"

Photometers,

with Fittings and Bench complete for Dark Room, as approved by the Gas Referees.

LOWE'S JET PHOTOMETER

(KIRKHAM AND SUGG'S IMPROVEMENTS),

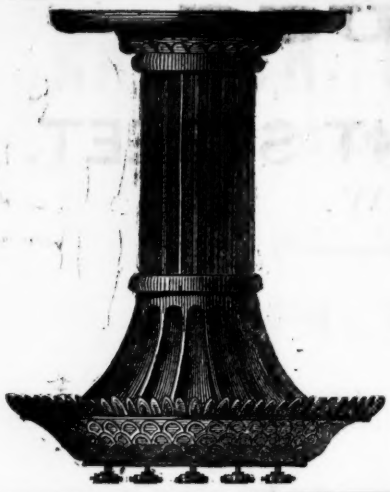
With new external Water-Line Regulator; Improved Micrometer, with Quadrant divided into 45 degrees; Valve, with *pro ratâ* opening; Improved Ventilator, Purple Glass Height of Flame Measurer; King's Gauge, working on Friction Rollers. In French Polished Pine Case. Diagram for ditto for finding the Illuminating Power in Candles.

PRICE £12 10s. COMPLETE.

Can also be had with additional Scale on Pressure Gauge, to show by inspection the Illuminating Power in Sperm Candles, at a slight extra cost.

NOTE.—When an order is given for a Jet Photometer with this latter addition, it will be necessary to state about the quality of Gas for which it will be used. The range in candles will not be more than three or four.

PRICE LISTS WILL BE FORWARDED POST FREE ON APPLICATION.



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GAS AND HOT WATER ENGINEERS,

155, CANNON STREET, E.C.

Manufactory: 19 & 20, NICHOLAS LANE, E.C.

SUN-BURNERS,

With Regulating Valves to obviate down draught.

MEDIÆVAL & OTHER GAS-FITTINGS

For Churches and Domestic Use.

ARCHITECTS' OWN DESIGNS WORKED OUT.

ESTIMATES FREE OF CHARGE.

THE TRADE SUPPLIED.

SOLE CONSIGNEES FOR BRÖNNER'S IMPROVEMENTS IN GAS LIGHTING.

IN THE MATTER OF

BRÖNNER'S GAS-BURNERS.

HENRY GREENE AND SON, 155, Cannon Street, London, Sole Agents for Great Britain, Ireland, and Colonies, of Brönner's Improvements in Gas Lighting, beg to inform the public that on the 13th of January, 1876, Julius Brönner obtained an injunction in the Court of Session, Scotland, against Donald M'Vean, Gas-Fitter, 14, Newton Street, Glasgow, prohibiting him from in any way advertising or offering for sale as Brönner's Burners, any Burner not manufactured by Julius Brönner, or from in any way inducing the public to believe that the said Donald M'Vean sells or keeps for sale Brönner's Burners, manufactured by Julius Brönner, while such is not the case.

Also that on the 9th of November, 1875, he obtained injunction in the same Court, and in the same terms, against R. M. Brechin and Co., 46, North Hanover Street, Edinburgh.

Also that on the 20th of April, 1875, in a suit in Chancery, before Vice-Chancellor Malins, number 1874, B 365, he obtained injunction against another defendant, in the same terms and on similar grounds.

MESSRS. NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS, NEAR SHEFFIELD,

MANUFACTURERS OF

IMPROVED CENTRE-VALVES,

PURIFIERS, CONDENSERS, SCRUBBERS, GASHOLDERS, ROOFS,

And every description of Gas Machinery.

TENDERS GIVEN FOR WORK FIXED COMPLETE IN ANY PART OF THE KINGDOM.

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WORKS:

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Manufacturers of

CAST-IRON GAS AND WATER PIPES.

SIZES: ¾ to 12 inches at GLASGOW.

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A LARGE STOCK KEPT, AND PRICES MODERATE.

Freight to London, in the Stream, 10s. per ton from Stockton; 12s. 6d. from Glasgow.

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LAURENCE POUNTNEY LANE, LONDON, E.C.,

SOLE MAKERS OF

MORTON'S PATENT SELF-SEALING

RETORT-LIDS,

WITH

HOLMAN'S NEW PATENT

BRACKETED CROSS-BARS,

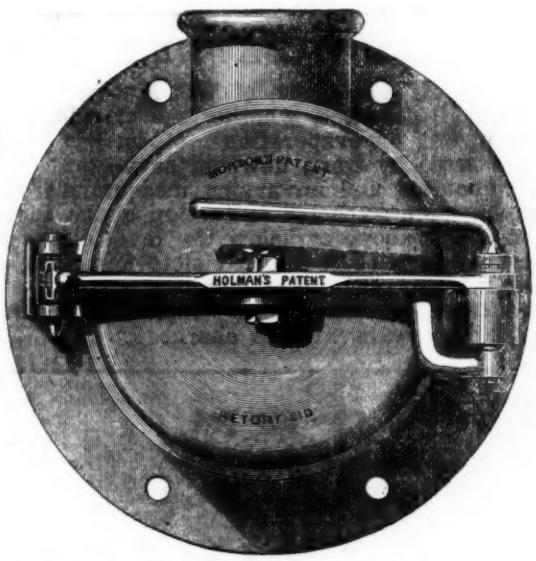
ANTI-FRICTION CATCHES, AND ECCENTRIC FASTENINGS.

NO LUTING.

NO DUPLICATE LIDS REQUIRED.

INSTANTANEOUS SEALING EFFECTED.

VERY DURABLE.



HOLMAN'S NEW SELF-SUSTAINING CROSS-BAR ENSURES FREEDOM OF JOINT, AND MAINTAINS PARALLEL POSITION OF THE LIDS.

By the employment of MORTON'S PATENT SELF-SEALING RETORT-LIDS, with HOLMAN'S PATENT ECCENTRIC FASTENINGS, the old-fashioned, cumbersome, and expensive method of sealing Retorts, by luting the lids with lime and other materials, is entirely dispensed with.

Since their introduction in 1869, these Patent Retort-Lids have been thoroughly tested, over 20,000 being in use at various Gas-Works in London and the Provinces, among which may be mentioned:—

The Gaslight Co., Beckton (where nearly 4000 are in use).
" Gaslight Co., Bow Common.
" Gaslight Co., Silvertown.
" Gaslight Co., Lupus Street.
" London Gaslight Co.
" Independent do.
" Phœnix do.
" South Metropolitan Gaslight Co.
" Commercial do.
" Imperial do.
" West Ham Gas Co.
" Gas-Works, Barnet.

The Gas-Works, Royal Arsenal, [Woolwich.
" do. Lower Sydenham.
" do. Brentford.
" Consumers Gas Co., Woolwich.
" Alliance and Dublin Gas-Works.
" Edinburgh do.
" Manchester Corporation do.
" Salford do. do.
" Rochdale do. do.
" Liverpool Gas-Works.
" Birmingham do.
" Birkenhead do.
" Nottingham do.

The Newcastle-on-Tyne Gas-Works.
" Lurgan do.
" Carmarthen Gas-Works.
" Merthyr Tydfil do.
" Windsor do.
" Leeds do.
" St. Albans do.
" Over Darwen do.
" Rotherham do.
" Aylesbury do.
" Bournemouth do.
" Ystrad do.
" Cardiff do.
" Rochester do.

The Keighley Gas-Works.
" Aberdare do.
" Ballymena do.
" Richmond do.
" Stalybridge do.
" Longton do.
" Exeter do.
" Ross do.
" Falmouth do.
" Barrow-in-Furness do.
" Belfast do.
" Wakefield do.
And other Provincial and Foreign Gas-Works.

IMPORTANT TESTIMONIAL.

The Gaslight and Coke Company (Commonly called the Chartered Gas Company), Beckton, North Woolwich, July 2, 1874.

MESSRS. TANGYE BROTHERS AND HOLMAN.

Gentlemen,—In answer to your inquiry respecting the Self-Sealing Lids, I beg to say that they continue to work well, and I have every reason to be satisfied with them.

I should be very sorry to return to the old system of Luting, and our stokers here freely acknowledge the benefit to them of the new system.

I am, yours truly,
(Signed) G. C. TREWBY.

London, 1851. New York, 1853 Paris, 1855. London, 1862.

Dublin, 1865

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

Paris, 1867.

THOMAS GLOVER & CO.,

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JUNE 6, 1876.

Circular to Gas Companies.

The Burghs (Scotland) Gas Supply Bill—as the measure we have before referred to, under a longer title, is now named—seems likely to become law. It has been altered more in form than substance during the process of re-commitment; but, as Mr. W. Livesey points out, in another column, some of the alterations made are material. Statutory gas undertakings, whether municipal or commercial, are still protected from compulsory purchase, and from competition; but non-statutory undertakings are laid more open to attack. It seems, however, from Mr. W. Livesey's communication, that the companies most interested do not seriously object to this treatment. There may be a feeling abroad among Scottish gas companies, mostly small, and not universally prosperous, that it is not worth while to spend time and money in a contest with, what we may call, the spirit of the age. If so, let them part with their undertakings, as fast as they can, or choose, and retire with dignity, with the best annuities awarded. We confess, however, to a fear that presently some enterprising and ambitious legislator, imbued with current notions, may take it into his head that what is good for Scotland may be good also for England; and the result may be the introduction of a general measure, such as we are now considering, to facilitate the confiscation of the non-statutory undertakings in this country. We are afraid that such a measure would be received with favour by a considerable section of the present Legislature, and we know how large is the number of Corporations and Local Boards, who are itching to get possession of gas undertakings.

It will be curious to see how many Scottish Burghs will avail themselves of the powers this Act, when passed, will confer. In England, the desire of local authorities to acquire gas undertakings, is stimulated by the wish to make profits to be applied for public purposes—in other words, to levy an additional rate on gas consumers, for the general benefit of all the inhabitants, ratepaying or not. In Scotland, on the contrary, the general practice is, and it will be made compulsory wherever this Act is adopted, to supply gas at what may be called cost price; and if a profit be made in the course of one year, it must be immediately applied to the reduction of price in the next. Thus, it may be said, that the only object a Scottish Burgh can have in adopting the Act is a purely benevolent one—the desire to benefit gas consumers. How far Commissioners may be actuated by this inducement, remains, as we have said, to be seen. It may, perhaps, turn out that, after a full consideration of the circumstances, a conclusion may be come to, that companies are able to supply gas at as cheap a rate as a body of Burgh or Police Commissioners, especially when these latter, having purchased an undertaking, will have to pay the company's profits in the shape of annuities. Thus, we do not expect to see a single case of competition; nor do we anticipate a very general adoption of the Act. Nevertheless, the principles of it must be protested against, and every precaution must be taken to prevent the application of a similar measure to this country, with the right to tax, which every English local authority desires.

We publish to-day, with some misgivings, a letter from Mr. R. H. Patterson, which, we fear, may open up a long dispute. We altogether disapprove of the *tu quoque* style of argument; still, we consider that it might have been deemed unfair treatment, if we had deprived Mr. Patterson of the opportunity of stating his case, as against the Board of Trade, from his own point of view. The objections we took to his proceedings, as soon as his application for a patent was published, were based on moral, rather than legal grounds. *We* have never disputed his legal right to take out a patent for the purification of gas from "sulphur." Whether, or not, he had such a right, is still to be decided. The decision of the Lords Justices only concerned the validity of the patent on other issues. We do not remember that the legal right of Government officers to take out patents for discoveries and inventions made at Government expense, and in the discharge of their official duties, has ever been called in question; but we know that public opinion, as represented in the House of Commons, has expressed itself strongly on the moral part of the question. We were under the impression, and still entertain the opinion, that the Crown has a right to the use of any patented invention, without payment of royalties. Inventors, we know, have been rewarded with gratuities; but we do not think that they ever *directly* received royalties from the Government. The cases, however, of, say, Admiral Boxer and Mr. Abel are not strictly analogous with that of Mr. Patterson. The sting in this gentleman's case is, that the position he occupied as a Referee empowered him to prescribe a limit of "sulphur" impurity, and thus gave him practically the opportunity of compelling the use of his patent by the three companies under his supervision. It was a different matter with regard to that "majority of the larger "works throughout the kingdom," in which the patent is said to be in use, and we consider it somewhat unfortunate for Mr. Patterson that he did not take proceedings against one of these, instead of the Chartered Company.

We are, as yet, without information as to whether or not the directors of the South Metropolitan Gas Company will withdraw the Bill, the preamble of which has been passed by the Committee of the House of Commons. If they have hesitated to take this step, no doubt the decision of the Lambeth Vestry to carry on the opposition in the House of Lords, with a view to get the initial price reduced to 3s. 3d. per 1000 feet, will induce the directors quickly to come to a determination. Not that we believe the vestries have the smallest chance of succeeding in their object; on the contrary, we have a strong suspicion that the company might, if they were energetic, succeed in getting the Bill sent back to the Commons with the initial price of 3s. 9d. reinstated. It will, however, be a much wiser plan to withdraw the Bill, and allow events to take their course. If that be done, it is extremely probable that the Chartered Company's Bill is the only measure relating to the metropolitan gas supply which will be passed this session. The proposed measure of the Board of Trade may not be introduced for some weeks, and as there exists no reason why it should be pressed forward, it will probably, after reaching its second stage, stand over until next session.

We pointed out, however, last week, for the benefit of the Vestries of Camberwell and Lambeth, that the Government Bill, whenever introduced and carried, will most certainly provide for uniformity of initial price, just as the Regulations Bill of the Metropolitan Board does. The selfish desire of the vestries named, to keep the South Metropolitan Company isolated, will defeat its own object. No other company will amalgamate with them, tied down to an initial price of 3s. 6d.; but, as we pointed out last week, there will be nothing to prevent the South Metropolitan from amalgamating with another company empowered to charge 3s. 9d. Seeing also this ungracious opposition to the South Metropolitan, the other transpontine companies may not be long in forming an opinion, that it will be to their advantage to enter into some combination. We know that the Board of Trade have expressed a strong opinion in favour of complete amalgamation; but, perhaps, their new Bill may confer a general power on all the companies to amalgamate *inter se*, in which event a southern combination might be formed, whether

the South Metropolitan Company's Bill pass or not. In any case the ultimate defeat of the opposing vestries is certain.

We observe one provision in the amended Bill, which may have been in the original measure, but which must have escaped our notice or memory. Before the company can issue any new capital under the provisions of this Bill (if it should pass), they are required to raise, by borrowing on the mortgage of the undertaking, all the loan capital authorized by their Act of 1869—viz., £62,500. The course the directors will take, if the measure be carried, is perfectly clear. They will offer this capital to existing shareholders at the maximum rate of interest of five per cent. In that way some small benefit will be conferred on the proprietors; the last, perhaps, the directors may have it in their power to confer. We feel so confident that, on mature reflection, this Bill will be withdrawn, that it is unnecessary for us to stop now to point out the possible consequences of one particular section.

We omitted to mention, last week, that Mr. Field, in his publication for this year, has made an addition which will save his subscribers a good deal of trouble, in the shape of tables, showing comparisons of some of the principal items in the accounts of the Metropolitan Gas Companies for the years 1871-5 inclusive. We reserve, as usual, all comments on the accounts for the past year, until we furnish our own abstract, in the form we have adopted for many years.

The meeting of the British Association of Gas Managers, which opens on this day week, will, we hope, be as successful as those which have preceded. Mr. Matthieu Williams is a most able lecturer, possessing a perfect acquaintance with the subject of which he proposes to treat; and, moreover, with the skill to recognize the particular information desired by a special audience. We expect, therefore, that the "Different Qualities of Iron and "Steel" will be discussed in such a manner as will be most useful to gas managers. "Piece-Work or Day-Work" is now, we might say, a delicate subject for discussion; but the stokers union is dead, and, probably, will not enjoy a resurrection for some time to come. We know, pretty well, what Mr. G. Livesey will have to say on the question, "Is the Reduction of the Sulphur Com-"pounds worth the Cost and Trouble it Entails?" seeing the difficulty he has in disposing of the spent lime on his premises. The question is, however, quite open for discussion, and Mr. Livesey, no less than ourselves, will be happy to obtain a general expression of opinion from gas managers. The question, we may add, acquires additional interest to-day, in consequence of the views, recently put forward, that it is oxygen dissolved in the pure condensed water, which does the mischief beyond all question experienced. We shall not now put forward the arguments *per contra*. Every gas manager earnestly desires to see "Sunday "Labour" reduced, and Mr. Woodall's paper is certain to be listened to with attention. The worthy President for the year and Mr. Woodall have been pioneers in the matter, and the results of their experience will be most valuable. Mr. W. Richards is a thoroughly practical man, of great experience, and whatever he may have to say on "Heating Retorts," we are certain, will deserve attention. The "Further Experience" of Mr. Livesey "with Concrete Tanks" will be listened to with much interest. The concrete, is the tank of the future, wherever local circumstances do not forbid its construction. Few, we believe, are better able to treat of "Mains and Services" than Mr. W. J. Warner; and, seeing the efforts the Crystal Palace District Gas Company have made to popularize, as we may say, the use of gas, Mr. Watson must be well able to instruct us as to "The Best Means of Extending the Use of Gas." The question, "Is the Removal of the Dip desirable?" can, in our opinion, be answered in but one way. The matter for discussion will be the best means for removing the dip. The "Valuation of Am-"moniacal Liquor" is a most important matter to gas companies, and may, in view of certain processes now put forward, become of more importance still. We shall be glad to hear what Mr. Child has to say on the question. A paper on "A New Self-"Regulating Exhausting Apparatus" is certain to command attention, although there appears to be an opinion in some quarters, that, under some circumstances, the employment of exhausters may be advantageously dispensed with. Mr. R. P. Spice contributes a paper on "The Comparative Working Results of West's "Mechanical Stoker," an instrument for which, we think, there is a good future, and "The Relative Advantages of Washers and Scrub-"bers" is to be treated of by Mr. C. Hunt, of Birmingham. The question is an interesting and important one, and is in very competent hands.

A few words of welcome to the President must be said. Mr. Morton has never put himself prominently forward, even on the Sunday labour question, the agitation on which may be said to have resulted from his philanthropic efforts to ameliorate the condition of the stoker. It may, however, we think, be said, that no man has a more thorough mastery over the details of gas manufacture and distribution, and, under his direction, we anticipate a most successful meeting for the Association. The excursion to the Beckton works will prove of the greatest interest to the members. Since the last visit of the Association, wonderful extensions and great improvements have taken place. If these latter are carefully pointed out, as no doubt they will be, no manager can leave Beckton without gaining useful and very valuable information.

As all our readers know, the JOURNAL OF GAS LIGHTING was started to defend the interests of commercial enterprise, as developed in gas undertakings, in the belief that the public are as well, and, in most cases, better, served by gas companies than by local authorities; while many considerations point to the advantage to a community of having as many opportunities as possible for the useful and profitable employment of capital. We have, therefore, always deprecated the transference of gas undertakings to local authorities; but when such transfers have taken place, we have always been ready to support the purchasing authority in the conduct of their business. It is, then, in no spirit of animosity to the Corporation of Birmingham, that we mention the fact, that the local journals are just now teeming with communications, making exactly such complaints as have recently been made against the gas companies in East and South London, and Dublin. The peculiarity in Birmingham is a most remarkable one. It would appear, from the letters in the newspapers, that the accounts of "Radical" consumers have diminished in amount since the transfer to the Corporation, while those of "Conservative" consumers exhibit an extraordinary increase. Is it possible that a piece of mechanism like a gas-meter can be imbued with party proclivities? It is a fortunate thing that gas companies have no politics, and, therefore, we may confidently say, that no meter lent gratuitously, or paid for on hire, has had its revenge on Mr. Turney, of Camberwell, with whose political bias, however, we are, happily, unacquainted. The moral we draw from the Birmingham and other disputes is, that Companies and Corporations alike should arrange for a periodical examination of their meters, and then they may treat these complaints—not unfrequently, we fear, involving mendacity—with the contempt they deserve.

Water and Sanitary Notes.

THE coming struggle in the House of Lords, between the Stockton and Middlesbrough Water Company, and the Corporations which bear the same name, commands unusual attention. We have already pointed out that the Bill, which has left the House of Commons, is purely a measure of confiscation. It will, if passed, offer the very first instance in which a Corporation have been empowered to make the compulsory purchase of a water undertaking, unless the same had been provided for by previous legislation. The Gas and Water Companies Association, therefore, make a strong appeal to the gas and water interest in the kingdom, to protest against such a shameful violation of the rights of private enterprise. It is most important that gas and water companies throughout the country should join in a protest against such legislation as is proposed, and has, indeed, been sanctioned (with some reserve) by a Committee of the House of Commons; and that they may do so with effect, we print in another column a form of petition, which should be signed and forwarded before this day week.

The Corporation of Middlesbrough, we rather think, are not quite easy in their minds as to the financial consequences if the Corporations Bill should be passed. They seem to begin to recognize the "white elephant," and would, we fancy, back out, only their pride will not allow them. We think, however, they may be consoled. The House of Lords, unless we are greatly mistaken, will reject their Bill.

The Town Council of Liverpool have practically endorsed the views of their Water Committee, and we might add that, so far as the Council are concerned, Mr. Hawksley's Windermere scheme would have been adopted. But an engineer of eminence, it is said, who is at present nameless, has laid before the Council a scheme for supplying Liverpool from Hawes Water, a lake nearer to the city than Windermere. The knowledge of the lake district we possess inclines us to the belief that Hawes Water would not suffice for the supply of Liverpool alone, while Windermere might furnish enough, not only for Liverpool, but for several towns lying on the route of the proposed aqueduct, and, if two rivals could come to an agreement, Manchester also. We shall presently hear more of the Hawes Water scheme, and may then be better able to judge of its merits. There is a strong desire on the part of some members to dispose of the Rivington works, which they might possibly do at a profit. The Windermere scheme, if adopted, might permit of this sale; but if Hawes Water should be selected for the additional supply, it would, we fancy, be necessary to retain the Rivington works.

The water accounts of the Corporation of Liverpool for the past year have been published, but only an abstract has yet reached us. From this it would appear that the receipts and expenditure are very nearly balanced. The total receipts amounted to £180,996 1s. 6d., while the ordinary expenditure was £176,238 17s. 6d., to which must be added the sum of £3000, set apart for the depreciation-fund.

Dr. E. J. Mills, the able Professor of Technical Chemistry in the University of Glasgow, has resumed the periodical examination of the water supplied to the city from Loch Katrine. We have before us the analyses made in March, April, and May of this year, and are somewhat struck by the last sentence of the report, which states that "the May water is in a *much "less suspicious condition"* than that of the previous months. The Doctor states that "the ratio of carbon to nitrogen was abnormally high in March and April;" and in a previous sentence remarks that the water is interesting to chemists on account of the variations of its composition. From the analyses before us we assume that these variations are principally in the amount of the organic constituents, carbon and nitrogen, for the amount of inorganic matter seems tolerably constant. We may suggest an explanation. The last time we rowed about the lower part of Loch Katrine, we came across the putrefying bodies of two sheep floating on the water. That was years ago. Whether the Corporation now take pains to remove such objectionable organic matter from the water, we do not know; but we hope they do.

The Bill of the Wakefield Water Company, the preamble of which has been passed by a Committee of the House of Commons, is to be opposed by the Wakefield Corporation in the House of Lords. The unlucky company have been before Parliament with several schemes for some years, and their parliamentary expenses must have been enormous. It is alleged that the Corporation have spent some £30,000 or £40,000 in opposition. The company's expenses probably much exceed this amount. We leave the statement without comment to-day, hoping soon to learn the real facts; but this case, and that of Stockton and Middlesbrough, referred to above, clearly point to the urgent necessity for some alteration in the law, or parliamentary practice. These enormous costs all come out of the pockets of the ratepayers, whether incurred by Company or Corporation. Opposed, as we are, to centralization, we could fain hope that the Government will find some means of stopping this disgraceful squandering of money. We believe it is beginning to be recognized that an inquiry before a parliamentary committee is, for the most part, an expensive farce. Perhaps no finer field for a true political satirist exists to-day than is to be found in a parliamentary committee-room.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

XCVI.

Beckton Gas-Works.

In the years 1870-71 we published in the Journal a series of drawings of the various buildings and plant at the Beckton works of the Chartered Gas Company. These engravings were produced by photo-lithography from the large working drawings placed at our disposal for the purpose by Mr. F. J. Evans, the engineer-in-chief of the company, from whose designs, and under whose superintendence, these gigantic works were erected. These drawings were subsequently published in a volume, with full letter-press description, but no detailed account of the several parts of the undertaking at Beckton has ever been given in the Journal.

The approaching visit of the members of the British Association of Gas Managers to the Beckton works suggests the appropriateness of a general description of this, the largest establishment in the world for the manufacture of gas, and we proceed to give it, accompanied by a two-page engraving of the plan of the works.

The Beckton Gas-Works are situated on the Thames, on the Essex side of the river, nearly opposite Woolwich, and about 3½ miles from Canning Town, from which place to the works the company have constructed a fine wide road, and in the immediate neighbourhood a handsome iron bridge of 175 feet span over the river Lea, for the purpose of carrying their mains to the Metropolis. A more direct route has also been provided by them by the formation of a railway, extending from the works to the Custom House Station of the Great Eastern Railway Company, a distance of about 1¾ mile.

It is well known that after the Chartered Company had been in existence upwards of half a century, and had expended immense sums from time to time, to augment their premises, the demands for gas so largely exceeded the productive capacity of their three stations at Westminster, Brick Lane, and Curtain Road, that another and more extensive locality became indispensable. Considerable difficulty was experienced in obtaining a desirable site; but, eventually, choice was made of the land at Beckton, which offered great facilities for unloading the coals, was beyond all possible complaints on sanitary considerations, besides possessing other advantages. The selection of this locality, however, presented obstacles by which the intelligence of the company's engineer was fully tried, and the expenses of the buildings greatly increased. These arose mainly from the unstable nature of the ground, and certainly a worse kind for the erection of massive buildings could scarcely anywhere be found. The soft nature of the ground is made evident, even at the present time, by it sinking to a depth of three or four feet with the weight of the coal only, in some instances leaving the piles which support the cast-iron columns of the viaduct, exposed for that length, and giving continuous occupation to fill up the recesses so formed.

The site was formerly a marsh, and before the company commenced operations, the surface and for two or three feet below, was an average earth, but beneath this, and for a depth of from eight to twelve feet, there exists a loose earthy peat, as may now actually be seen in section in the immediate neighbourhood, where some extensive excavations are being made for the formation of a dock. Beneath the peat is a stratum of loose earth, and underneath this, at a depth of about 24 feet from the present ground-level of the works, gravel was reached, on which all the foundations of the various buildings are constructed. Part of the ground was reclaimed from the river by building a wall 900 feet long and about 300 or 350 feet in advance of the old boundary.

As our engraving (even after our readers have studied the scales) must convey but a very feeble idea of the magnitude of these works, we may state that they occupy an area of 150 acres, the whole forming an area equal to that of an ordinary town of 10,000 or 12,000 inhabitants. In addition to this there are about 150 acres belonging to the company in connexion with the road to London.

The most important features in the design of these works are the means of discharging the coals from the vessels, and the means of saving of labour, by the adoption of railways, alike in the retort-houses, the yard, the coke vaults—indeed, everywhere throughout the whole of the vast premises.

For the first named purpose, there is constructed a massive and ornamental jetty or pier. This, in the plan, is represented in the form of the letter T, as it will be, when completed, in the course of a short time, but, at the present time, only the western portion is finished. This portion has been in active operation about six years; for the present we will confine our remarks to that. The pier has a total length of 718 feet, including the abutment on the river wall, that part which is parallel to the river wall being situated about 400 feet therefrom. By this system two vessels can be discharged simultaneously, the one being within and the other without the pier, the depth of water being sufficient for vessels of 1200 tons.

The pier is formed by 30 cylindrical cast-iron columns, each 6 feet in diameter, and projecting about 25 feet above high water. Those at the farther end, parallel to the river wall, are placed three abreast, braced and stayed together, each carrying wrought-iron longitudinal girders upward of 60 feet in length, and leaving a clear way beneath of that width. At the shore end the jetty is diminished in width, and the piers consist of two cylindrical columns, with longitudinal girders similar to the others; cross girders, carrying the railway sleepers, complete the frame of the pier. The whole is covered with planking, forming a platform or stage of 44 feet wide at the head, and 25 feet wide at the other part, which width is maintained throughout the whole length of the double viaduct. On the platform are six steam cranes, three of them being for discharging vessels moored on the inside, and the others for unloading vessels on the outside of the pier. There are also places not unlike railway signal-boxes for the men in charge of the engines actuating the cranes.

On this platform are three lines of rails and two weigh-bridges, so that, if necessary, any cargo can be weighed as delivered; and as a precaution, a sample of about 1 cwt. is reserved of every cargo received, so that, if any doubt of the quality exists, it may be immediately tested. Beneath the platform is a stage of the same width, resembling the main-deck of a vessel. Here there are two 25-horse power boilers, which drive the engines necessary for working the cranes. A set of signals and switches placed at the shore end of the pier direct the drivers of the locomotives to the place where the coal is to be conveyed.

The vessels bringing the coals are steamers of from 700 to 1200 tons burden, generally having three hatchways corresponding with the three steam cranes. Each crane is provided with ⅝-inch chain, and its corresponding tilt-buckets, capable of containing each 13 cwt. of coal. These are lowered successively to their respective hatchways, and, on being filled, are lifted with great speed. The crane is then turned round to bring the bucket containing the coal immediately over the waggon intended to receive it, when the man in charge detaches the lock, the bucket tilts over and is emptied. It is then reversed in the position for receiving the coal, the lock assured, when the crane swings round again, and the bucket descends to be filled. In the meantime, a second bucket has been filled in the hold, and is ready for lifting, and thus the work is carried on.

All the operations are so rapid and secure from danger as to excite the greatest admiration; and such is the speed with which the work is done, that a vessel having a cargo of 1000 tons of coal, can, with three cranes only, be discharged in five or six hours. Indeed, we have been assured that, on more than one occasion, 4000 tons of coal have been unloaded at this pier, and delivered by the locomotives and waggons into the retort-houses or stores in one day. When the pier is completed, as represented in the drawing, there will be 15 cranes, capable of unloading, if necessary, 10,000 tons of coal per diem.

We are dealing with figures of such magnitude, that, in order to appreciate their full value, we may make a comparison between the method here adopted of receiving coals, to that formerly applied by the same company at other stations. For this purpose we take the

lesser figure, 4000 tons, which has actually been discharged in a day at Beckton, and, supposing the waggons formerly employed to contain three tons of coal each, and to work continuously during ten hours, no less than 133 waggons per hour, or more than two per minute, would be required to enter the works to deliver the quantity of coal mentioned. To further appreciate the advantages of the improved means of discharging coal, we must remember that the value of a vessel of the tonnage in question is about £6 per diem, and, according to the usual method, only 40 or 50 tons are delivered daily. By the rapid discharge, therefore, a vessel can make three or four voyages instead of one, and thus a considerably reduced freight is obtained, whilst, by the means of transport into the works, the labour of carriage from the ships is avoided, as well as that of depositing it in the retort-house, all producing an economy which may be fairly estimated at 2s. 6d. per ton after deducting the expenses, which, upon 300,000 tons, represents the sum of £37,500 per annum.

In connexion with the pier, there are viaducts extending in direct line between the two rows of retort-houses, having two lines of rails throughout the whole extent of the buildings. There are other viaducts in connexion with the former, on each side within the retort-houses.

An idea of the system of viaducts is conveyed by the elevation in the engraving. The columns represented are of cast-iron, each being 20 feet long and 12 inches in diameter, and, on account of the unstable character of the site, each of these is supported by a pile 15 inches diameter, driven a depth of about 30 feet into the ground. These columns are ranged 25 feet apart longitudinally, and 12 feet from each other transversely; and on them are placed longitudinal wrought-iron girders, to which are attached the cross girders, carrying the rails, the sides being planked over, and, for security, hand-rails extend the whole length.

In addition to this extensive system of viaducts, which may be termed the high level, there is another railway extending throughout the works, which may be called the low level, and is indicated by a single line. This latter is in direct communication with the eastern and western jetties, and is more particularly employed for conveying the coke, and for transporting the goods discharged upon the jetties for the works—as retorts, bricks, ironwork, or chalk, which is burned on the premises to produce the lime for the purifiers. Communication exists between the high and low level lines, so that a locomotive with its waggons, on leaving the pier or platform, can enter the retort-houses, or pass along the main viaduct, between the retort-houses, along the double viaduct, to the point D. There it enters the single viaduct on a curve, and afterwards descends the incline, shown in elevation in the lower part of the engraving, along another curve on to the main line. It can then back past the station, continuing along by the side of the holders, to either of the jetties, and from thence it can pass along the sides of the retort-houses, or to any part where the single line is indicated; to the coke vaults alone, on account of the height, it is precluded from entering.

A locomotive shed has been completed, which is sufficient for twelve engines, with turn-table in the centre, so that they can be shunted over their respective ash-pits. At present, there are nine locomotives on the works, some of them being employed by the railway, the others for transporting coal and coke. The gauge for the rails throughout is similar to that generally employed—that is, 4 feet 8 inches between the rails. In short, the operations of transporting the coals, coke, and other articles, as adopted at these works, may be described as simply perfection. In addition to the locomotives, there are thirty horses employed on the low-level line, for conveying the coke to the barges or to the railway, or to carry chalk to the lime-kilns, &c.

Beneath the viaduct in the centre, when space is not available in the retort-houses, the coals are stored, and, to render the means of transport complete, there is a travelling steam crane on this viaduct, which, by a process similar to that at the pier, lifts the coals from beneath, and places them in the waggon to be conveyed to the retort-house, wherever required.

The retort-houses which are, or have been, in use, are eight in number, situated as in the plan, those marked 1, 2, 3, and 4 being 360 feet long and 90 feet wide; the others are of the same length, but 100 feet wide. The retort-house No. 9, together with its benches, is near completion, and will be in operation this year. No. 10 is in the course of erection, and may probably be in action next year; the two last mentioned houses are each 460 feet long. The foundations of these buildings, as well as the benches of retorts, extend to a depth of 24 feet below the present surface of the ground.

It is almost needless to state that each retort-house has its coke vault, with the firing-floor above; indeed, it would be utterly impossible to go through the work of this establishment except by these means. The elevations of the retort-houses have an elegant appearance, which has been acquired at a nominal extra cost, by excellent design, and a skilful application of small portions of terra cotta and red bricks; and the same style of elegance and neatness pervades the whole of the buildings.

Each house contains 30 benches of double retorts, eight in a bench, or 480 mouthpieces. The retorts are D-shape, 18 inches by 12 inches, and 20 feet long each, all fitted with Morton's self-sealing retort-lids. The coke vault on each side of retort-house is about 35 feet wide and 8 feet high, and has a railway extending the whole length. Iron trucks, each holding about a chaldron, convey the coke, directly it is quenched, to the barge or rail intended to receive it. The furnaces are clinkered, and supplied with fuel from the coke-hole; and the coke, as drawn from the retorts, falls there, and is quenched by the men employed for the purpose.

The firing-stage of the retort-house is constructed of cast-iron plates. The space of this building actually required for the benches, and for the operations of charging and drawing, may be assumed to be about 50 feet in width; the rest of the building on each side may be regarded as a coal store—to which purpose, indeed, it is applied—this being one of the many important points on the grounds of economy existing in the design of the works. Another object of these capacious buildings is probably to obtain good ventilation, which was sadly neglected in the old-fashioned retort-houses, where the men, after each charge, were glad to go to the door or any opening "to get a mouthful of fresh air."

About 10 feet from the interior of the walls of the retort-house is a line of cast-iron columns, situated 20 feet apart from each other, which carry the principals of the roof. To these, at the height of 15 feet, are attached cast-iron girders, extending the whole length of the retort-house. Cross girders, supported at one end by the wall, and at the other end by the longitudinal girder, form the viaduct for each side of the respective retort-houses. The sleepers and rails are laid on these, over which travels the locomotive with its trucks of coal; and, in order to avoid the necessity for tilting, the bottoms of the trucks are made so as to slide out, and deposit the coal immediately beneath. This arrangement is carried out on both sides in all the retort-houses.

At the height of 22 feet from the firing-floor, another girder extends the length of the building, and is attached to the cast-iron columns mentioned. The roof principals are cast iron, elliptical in shape, the end of each principal being supported by a cast-iron column, the centre of the arch being about 45 feet above the firing-stage.

Among the many ingenious innovations introduced by Mr. Evans in designing these works, one is the advantage taken of the rainfall as a supply of water to the works. For this purpose he has superseded the ordinary gutters, which serve only to carry away the water, by a tank or large gutter, as it may be called, extending the length of each retort-house, and placed on a level with the upper girder, which retains the water for the purpose of quenching the coke. By this means, during a considerable portion of the year, the whole of the water requisite for that operation is obtained.

(To be continued.)

COMPULSORY PURCHASE OF STATUTORY WATER-WORKS UNDERTAKINGS.

STOCKTON AND MIDDLESBROUGH CORPORATIONS WATER BILL.

The following circular letter has been addressed to the various companies throughout the kingdom, by the Gas and Water Companies Association, and we have much pleasure in endorsing the request that petitions to the House of Lords, against the above-mentioned bill, may be prepared and forwarded as early as possible:—

Gas and Water Companies Association, 6, Victoria Street, Westminster Abbey, S.W., June 2, 1876.

STOCKTON AND MIDDLESBROUGH CORPORATIONS WATER BILL.

Dear Sir,—The Association believing this to be the first case in which there has been an absolute and direct compulsory power of purchasing a water or gas company, think it desirable that the companies should make known their strong objection to such a principle being sanctioned by Parliament, by petitioning against the bill. I therefore enclose the draft of a petition for this purpose.

It is a somewhat unusual course to petition against a private bill in this way, but the circumstances of the case justify the proceeding.

It may be expected that the bill will be referred to a select committee soon after the House reassembles on Tuesday, the 13th inst.; petitions should therefore be presented before that date.

If it is not convenient for you to get a petition sealed by that time, it can be signed either by the chairman or yourself on behalf of the company, and if you do not know of any peer who would present it for you, I will get that done if you will be good enough to send it to me.—Yours very faithfully, W. LIVESEY.

In Parliament, Session 1876.

STOCKTON AND MIDDLESBROUGH CORPORATIONS WATER.

PETITION AGAINST THE BILL.

To the Right Honourable the Lords Spiritual and Temporal in Parliament Assembled.

The Humble Petition of the

HUMBLY SHEWETH:—

1. That a bill is now pending in your Right Honourable House, intituled "A bill for supplying with water the Boroughs of Stockton-on-Tees and Middlesbrough and other Places adjoining or near thereto, and for other purposes."

2. That power is given by the said bill to the two Municipal Boroughs of Stockton-on-Tees, in the County of Durham, and Middlesbrough, in the North Riding of the County of York, to purchase compulsorily the undertaking of the Stockton, Middlesbrough, and Yarm Water Company.

3. Your petitioners have been informed and believe that although such powers have frequently been applied for by local authorities, Parliament has hitherto invariably declined to grant them.

4. Your petitioners submit that it is a well-known fact that many local authorities are at the present time desirous of promoting bills for the compulsory purchase of the gas and water undertakings in their respective districts, but that the practice of Parliament not to approve of such bills has hitherto protected the companies from such proceedings.

5. That if the present bill were to be passed into a law by your Right Honourable House, the local authorities would regard it as a precedent to justify the promotion of other bills of a similar character, and the gas and water companies would be subjected to an oppressive and ruinous expense year after year in protecting their property from these unjustifiable transactions.

6. That by the Public Health Act, 1875, local authorities are empowered to purchase by agreement the gas undertakings in their respective districts, and the gas companies are empowered to sell their undertakings to the local authorities, but similar powers with respect to water undertakings the local authorities have had for very many years.

7. Your petitioners humbly submit that these powers are amply sufficient to enable the authorities to acquire the gas and water undertakings in their respective districts whenever there is any desire on the part of the inhabitants or other necessity for their so doing.

8. That compulsory powers for the purchase of private property in any case, and more especially in the case of property acquired under express parliamentary sanction, ought not to be granted except upon indisputable proof of strong and urgent public necessity.

9. That the compulsory purchase of a gas or water company cannot be justified upon any such grounds, experience having abundantly proved that in the majority of cases when the supply has been transferred from a company to a local authority, the public have not been benefited by the transfer, but, on the contrary, very much the reverse.

10. That these vexatious and arbitrary proceedings only subject both parties to a very large and unnecessary expense, without conferring any benefit whatever on the public, and are not entitled to the favourable consideration of your Right Honourable House.

Your petitioners, therefore, humbly pray your Right Honourable House not to allow the Stockton and Middlesbrough Corporations Water Bill now awaiting your consideration to pass into a law.

MEM.—Petitions may be written on paper or parchment, but on one side of the paper only, and fastened together so as to form a roll. They must not be lithographed or printed.

Correspondence.

"REFEREES AND PATENTEES."

SIR,—I am greatly obliged to Mr. Harcourt for joining in your expression of sincere sympathy on my behalf as to the great loss which I have had to sustain in connexion with my admittedly valuable "discovery" (whether patentable or not remains to be determined), whereby a long-existing difficulty has been solved, and the most urgently needed improvement in gas purification has been attained, and by the cheapest and simplest means possible. But I should have been glad if Mr. Harcourt, for his own sake, and that of others, as well as mine, had not volunteered to endorse the *obiter dictum* of Lord Justice James (in the face of the directly opposite opinion of Vice-Chancellor Bacon), which throws a doubt upon the statutory right of the Referees and Chief Gas Examiner to patent any improvements which they may devise in gas manufacture. If Mr. Harcourt merely means to say that it is improper for a Gas Referee *now* to take out a patent, after the Board of Trade have issued instructions to that effect, that is another affair, but one which does not apply to my case; no such instructions, whether directly or even implied, having been given either to me, or to the Referees as a body, until nearly two months after my patent had been taken out.

Until such special instructions were given, the Gas Referees were as fully entitled to patent inventions of their making as any other subject of the Crown. The right of public officers to patent improvements in their own sphere of employment is fully established, and has been recognized by the Government over and over again—the Crown paying large royalties upon such inventions. Moreover, the Gas Referees, in common with the Accountant and Chief Gas Examiner, are not members of the Civil Service, or Government servants in any right sense of the term, each and all of them being free to follow any profession they please, and their time also being their own, subject only to the performance of certain clearly specified duties "from time to time." Even the managers and other paid *employés* of the gas companies are free to take out patents in their own special work—as, indeed, was done by Messrs. Evans and Mann, and two other officers of the Chartered Company, in regard to this very "Sulphur question." In fact, the capacity for invention—certainly for successful invention—is one of the rarest faculties of the human mind, which can never be paid for by, nor is ever included in, wages or salaries of any kind; and it is so regarded in every branch of science and industry throughout the kingdom. Nor can I imagine anything more preposterous than for a gas company to complain of any one, whether in their own employment or an outsider, for devising and patenting an improvement in gas manufacture. If it be a useful improvement, is it not a benefit to them? If it be useless, they will not employ the patent. In my case, the improvement was such that it has entirely relieved the companies from fear of penalties, and from the previously incessant complaints of the Corporation and the Metropolitan Board of Works, which have wholly ceased since I made public my invention in March, 1872.

Mr. Harcourt says it is "unfair to him and the Board of Trade, by whom he has been reappointed from year to year," to establish a parallel between my taking out a patent, and his doing of the same thing. I agree with him that there is a very great difference indeed between the two cases, and I shall leave it to you, sir, and your readers, to say on which side the "unfairness" lies.

First, as to my case. 1. The terms of the Act under which the Referees are appointed in no way restrict them from making inventions or patenting them, and it would be strange if it did. As the Vice-Chancellor stated in his judgment, "the duties are very clearly prescribed; and I cannot say that I think the plaintiff was disqualified, by reason of his employment, from availing himself of any discovery he may have made." 2. We received no expression of opinion whatever from the Board of Trade adverse to the patenting of inventions until nearly two months after my patent had been filed; on the contrary, the only definition of our duties communicated to us by the Board of Trade, was simply a recapitulation of the terms of the Act. 3. The companies never made any experiments for me in connexion with my invention; although (unfortunately for me) I had communicated the chemical affinities upon which my invention proceeded to Mr. Trewby in a private letter on Feb. 15, 1872, three weeks before my patent was filed. My own experiments cost the companies nothing (the small 3 feet tin scrubber and purifying material with which I worked, having been purchased by myself), except about five shillings worth of the gas supplied to the office, and for which the Chartered Company at least were paid.

Thus, then, when I took out my patent, I was under no obligations of any kind to the companies. And what was my conduct thereafter? Did I keep my specification secret, as patentees usually do, and as Mr. Mann did; or did I resolve to turn my patent to the best account, as, like other patentees, I might well have done? Quite the contrary. My patent, after considerable delay, was filed on the 9th of March, and on the very first clear day thereafter (Monday, March 11), I called with my specification upon Mr. G. Livesey, of the South Metropolitan Company, and upon Mr. Phillips of the Chartered, and a day or two afterwards on Mr. Chubb, of the Imperial, and discussed the matter with them. No objection whatever was made by these official representatives of the three companies, under the supervision of the Referees, the only question was, "Will it do?" At the same time I told them that the companies might have full use of my patent "at a merely nominal royalty." Such was my conduct in this matter. I confidently expected, as I am sure I deserved, great credit for so important an invention, and for solving a supreme difficulty which, for 20 years, had baffled all the gas companies, aided by the most eminent chemists. I think, then, that any impartial reader will believe how astonished I was when, some two months afterwards, I received a reprimand from the Board of Trade for taking out this patent; the full benefits of which, I am confident, are as yet only half developed.

Now for Mr. Harcourt's case. I having been reprimanded for my patent, and non-reappointed, and the Board of Trade having expressed their opinion that it was improper for a Referee to patent improvements in gas manufacture, or, at least, in gas purification, Mr. Harcourt was appointed to be one of the Referees on the 1st of September, 1872.

Mr. Harcourt has filed three patents for inventions in gas manufacture and purification. The earliest of these (of which I have not a copy) he states was filed provisionally, before he became a Referee, but he proceeded with, and fully patented it afterwards. The other two patents of his are both entitled "Improvements in the Purification of Gas." The one referred to in your editorial note to Mr. Harcourt's letter, has precisely the same object as mine—viz., the purification of gas from sulphur in other forms than sulphuretted hydrogen; or, as you quote from his specification, its object is the "complete removal from gas of impurities existing as sulphur compounds." The process therein proposed by Mr. Harcourt is a very cumbrous, and, what is worse, an exceedingly costly one, consisting in reheating the whole of the gas in iron pipes filled with highly-heated pebbles or such like material, with the view to resolve the bisulphide of carbon into sulphuretted hydrogen, and thereafter to purify the gas (when recooled) from the SH_2 in the ordinary manner. Now, what was done in connexion with this patent? The common report is (indeed, I have been so informed by gentlemen connected with the companies under the supervision of the present Referees) that the Board of Trade requested or required the gas companies to try this costly patented process of Mr. Harcourt's on a manufacturing scale; and this trial was made—and, I believe, was continued for several months—at one of the gas-works, each of the three companies contributing to defray the expenses of the trial, which, I am told, amounted to upwards of £1000. What was the result I leave Mr. Harcourt to tell, for I only know by report; but certainly I have never heard that the said process has been adopted in any gas-works, whereas my process is now in use in almost every gas-works in London, as well as in a majority of the larger gas-works throughout the kingdom.

Mr. Harcourt's third patent, of which I have a copy at hand, was filed on Aug. 13, 1873, and completed on Feb. 12, 1874—2½ years after he became a Referee. Its "first" object is "to purify illuminating gas from sulphuretted hydrogen and from ammonia."

Such are the facts of Mr. Harcourt's case and mine. I ask your readers to "look upon this likeness and upon that," and say which they like best.

I know that the facts of my own case are here stated with literal exactness, and as the correspondence of the Board of Trade is about to be laid before Parliament, your readers will soon be able to judge further for themselves. If I have on any point incorrectly stated Mr. Harcourt's case, doubtless he will correct it with the same pleasure as he had in writing the letter to you, upon which, in justice to myself, I have had to comment.

June 1, 1876. R. H. PATTERSON.

BURGHS (SCOTLAND) GAS SUPPLY BILL.

SIR,—A short time since you were good enough to insert in your JOURNAL, at my instance, a few remarks upon the then extraordinary provisions of this bill.

As the bill has since then been referred back to the same committee, who have made some very material alterations, I shall feel greatly obliged if you will kindly permit me to state what has been done.

As the bill stands now—

All districts over which any statutory powers have been granted, whether to companies or local authorities, are exempt from its operation,

But with respect to any other districts that are now being supplied without statutory powers, the bill provides that the local authorities shall, before putting the Act into operation in those districts, give notice to any company supplying the same of their desire to purchase the undertaking of such company; and, if the company are willing to sell, but cannot agree upon terms, the terms are to be settled (without restriction) by arbitration. But if the company refuse to sell, the local authorities are to have the power to erect other works, and supply gas in competition with the company.

This seems strange to English ideas; but the gentlemen who came up from Scotland to represent the unincorporated companies consented to it, stating that if the companies would not sell their undertakings to the local authorities, they thought it was only right for the local authorities to have the power to supply gas in competition with them.

This bill has been reported as amended, and stands for committee of the whole House on Thursday, the 8th inst., unopposed; we may, therefore, expect that it will finally pass in this shape.

Gas and Water Companies Association, W. LIVESEY.
6, *Victoria Street, S.W., June* 2, 1876.

P. S.—Gas seems to be much more extensively used in private dwellings in Scotland than it is in England, every facility being given for its introduction into the very poorest dwellings. All gas supplied under the powers of this Act is to be of the quality of 25 candles.

ROCKHAMTON (COUNTY LIVINGSTONE, QUEENSLAND) GAS AND COKE COMPANY, LIMITED.—At a general meeting of this company on the 3rd of March last, a resolution was passed confirming the following resolution passed at a general meeting of the company held on the 11th of February, viz.—"That the capital of the company be increased to £15,000, by the issue of 1000 new shares, of £5 each, such new shares to be preference shares bearing interest at the rate of 9 per cent. per annum."

Parliamentary Intelligence.

HOUSE OF LORDS.

Monday, May 29.

The Lord Chancellor acquainted the House that no further Standing Orders are applicable to the Huddersfield Water and Improvement, and Paisley Water Bills.

The York New Water Bill was reported, with amendments.

The following bills were read a second time and committed:—Kildwick Parish Gas, Stockton and Middlesbrough Corporations Water, Whitehaven Town and Harbour Improvement.

The following bills, brought from the Commons, were read the first time, and referred to the Examiners:—The Gaslight and Coke Company, Newcastle and Gateshead Water, Smethwick Local Board.

The Gas and Water Orders Confirmation (Chapel-en-le-Frith, &c.) Bill passed through committee of the House, with amendments.

The Local Government Provisional Order, Skelmeradale (No. 5) Bill was read the third time and passed.

A petition against the Huddersfield Water and Improvement Bill was presented from Sir John William Ramsden, Bart.

Tuesday, May 30.

The Lord Chancellor acquainted the House that the further Standing Orders applicable to the Spennymoor and Tudhoe Gas Bill have been complied with; and that no further Standing Orders are applicable to the Bristol United Gas and Dewsbury and Heckmondwike Water Bills.

The Southampton Gaslight and Coke Bill, brought from the Commons, was read the first time, and referred to the Examiners.

The Slaithwaite Gas and South Hants Water Bills were read a second time and committed.

The Blackrod Gas and Llandudno Improvement Bills were read the third time and passed.

The Chesterfield Water and Gas Bill was read the third time, with the amendments, and passed.

The amendments to the Gas and Water Orders Confirmation (Chapel-en-le-Frith, &c.) Bill were reported.

A petition against the Huddersfield Water and Improvement Bill was presented from Medical practitioners within the Borough of Huddersfield; and one against the Tunbridge Wells Gas Bill from the South-Eastern Railway Company.

Thursday, June 1.

The following bills received the Royal Assent:—Local Government Provisional Order, Skelmersdale (No. 5), British Gaslight Company (Hull Station), Padiham and Hapton Local Board, Maidenhead District Gas, Edinburgh and District Water, Rossendale Union Gas.

The Lord Chancellor acquainted the House that the further Standing Orders applicable to the Lancaster Water and Improvement, and Tunbridge Wells Gas Bills have been complied with; but that they have not been complied with in the case of The Gaslight and Coke Company Bill.

The following bills, brought from the Commons, were read the first time and referred to the Examiners:—Burntisland Burgh, Colney Hatch Gas, Dunfermline Water, Halifax Water and Gas Extension, Norwich (City) Water, Oldbury Local Board of Health, Plymouth Dock (Devonport) Water, Wakefield Water.

The Huddersfield Water and Improvement, and Paisley Water Bills were read a second time and committed.

The Redcar and Coatham Gas, Gorleston and Southtown Gas, and York New Water Bills, were read the third time, with the amendments, and passed.

The Gas and Water Orders Confirmation (Chapel-en-le-Frith, &c.) Bill was read the third time and passed.

A petition against the Dewsbury and Heckmondwike Water Bill was presented from the Corporation of Huddersfield.

HOUSE OF COMMONS.

Monday, May 29.

The Southampton Gaslight and Coke Bill was read the third time and passed.

The following bills, as amended, were considered:—Burntisland Burgh, Cleveland Water, Halifax Water and Gas Extension, Tipton Local Board, Wakefield Water.

The following bills, as amended, were considered, and amendments made thereto:—Colney Hatch Gas, Dunfermline Water, Norwich (City) Water, Oldbury Local Board of Health, Plymouth Dock (Devonport) Water.

The Blackrod Local Board Bill (Lords) was read the first time, and referred to the Examiners.

Mr. Patterson's Patent for Sulphur Purification.—On the motion of Colonel Makins a copy was presented of correspondence between the Board of Trade and the Gas Referees in reference to Mr. Patterson taking out a patent for gas purification, and to the alteration of the position and duties of those officers.

Tuesday, May 30.

Burghs (Scotland) Gas Supply Bill.—This re-committed bill was reported from the select committee, with further amendments.

The Galashiels Municipal Extension, Police, and Water (Lords) and the Sevenoaks Gas Bills were reported.

A petition against alteration of the Metropolis Gas Companies Bill was presented from the Commercial Gas Company.

Wednesday, May 31.

A petition against the Blackrod Local Board Bill (Lords) was presented from the Leeds and Liverpool Canal Company.

Thursday, June 1.

The following bills were read the third time, and passed:—Burntisland Burgh, Colney Hatch Gas, Dunfermline Water, Halifax Water and Gas Extension, Norwich (City) Water, Oldbury Local Board of Health, Plymouth Dock (Devonport) Water, Wakefield Water.

The following bills, as amended, were considered:—Campbeltown Burgh and Harbour, Kirkcaldy Burgh and Harbour, North-East Worcestershire Water, South Metropolitan Gaslight and Coke, Uppingham Water.

On the motion of Sir Charles Forster, the order of the 13th of March, that the Walsall Improvement Commissioners Gas Purchase Bill be committed, was read and discharged. Bill withdrawn.

The Horncastle Gas Bill was reported.

The Llandudno Improvement Bill (Lords) was read the first time, and referred to the Examiners.

The Gas and Water Orders Confirmation Bill (Lords) was considered in committee and reported, without amendment.

HOUSE OF COMMONS COMMITTEES.

Tuesday, April 25.

(*Before Sir* John St. Aubyn, *Chairman, Earl* Percy, *Mr.* Randle Plunkett, *and Mr.* Bell.—*Mr.* Bonham-Carter, *Referee.*)

KILDWICK PARISH GAS BILL.

Mr. Richards, Q.C., and Mr. Michael, appeared for the promoters; Mr. Clerk, Q.C., and Mr. Lumley Smith, for the Keighley Local Board; Mr. Littler, Q.C., for the Silsden Local Board.

Mr. Richards opened the case for the promoters. He said the objects of the bill were to incorporate the Kildwick Parish Gas Company, to authorize them to supply gas in the parish of Kildwick, in the West Riding of Yorkshire, and for other purposes. The preamble recited that the various townships comprised in the parish of Kildwick were, as to some parts of them, insufficiently lighted with gas, and as to other parts, wholly without a supply of gas; that the populations of these townships were increasing, and it was expedient that provision should be made for effectually lighting the district. The capital of the company proposing by this bill to undertake that duty was set out in clause 7—viz., £30,000, in 3000 shares of £10 each. By clause 10 the usual borrowing powers were sought—viz., one-fourth of the share capital, and there was a proviso that these powers should not be exercised, except certain conditions were fulfilled. The maximum price of gas was to be 6s. per 1000 cubic feet, a price which, considering the prodigious rise which some time ago took place in the cost of coal, and might again occur, was not a very excessive margin beyond the actual price which would be charged under ordinary circumstances. The quality of the gas was to be such as to give an illuminating power of 14 sperm candles, and provision was made in the bill for properly testing the same. Clause 23 proposed to confer upon the company compulsory powers to take land, which was not a usual thing in gas bills. But the clause was compulsory only in form. The fact was that the persons from whom the land was to be purchased, were persons who had only a life interest, or some other limited interest, in the property, and the remaining men were under a disability, and therefore it was that the compulsory form was adopted, in order to satisfy those persons who, from their position, could not enter into an agreement, and who were anxious to be placed under such powers to enable them to effect a sale. They were willing to sell, and only wanted the authority of Parliament to enable them to do so. The parish of Kildwick was in the midst of the clothing district of the West Riding, and adjoined the parish of Keighley. It had a considerable population, amounting to 12,500 persons or more, who were chiefly engaged in the spinning of woollen yarns, and the manufacture of stuffs and worsted goods. It contained three railway stations, six churches, 24 chapels, 15 schools, 11 public buildings, no less than 22 worsted mills and sheds, with other mills, 83 workshops, 128 other shops, and about 2272 dwelling-houses. In the schedule two sites of works were spoken of; but the one which the promoters would alone ask for was the central one. The district comprised nine townships—Cononley, Upper and Lower Bradley, Silsden, Steeton, Sutton, Cowling, Glusburn, Kildwick, and Farnhill, six of which contained one, and three two small towns within their district; 18 out of 19 of the millowners of the district petitioned in favour of the bill, and one, Mr. Samuel Watson, who had petitioned against it, had since seen the error of his way, and withdrawn his opposition. One peculiarity in this district was that there were a large number of small private gas-works in existence—no fewer than 19—and their existence arose in this way. The millowners found it expedient to erect small works of their own, as they could get no light so cheap or so convenient as gaslight, and having erected works for their own private purposes, neighbours applied to them to supply them also, and so it happened very frequently that adjoining mills and cottages were lighted that way. Of the 19 millowners thus supplying gas, 13, as he had already stated, were in favour of this bill; five were neutral, for personal reasons which could be well understood, and the remaining one had now withdrawn his opposition; 475 of the principal inhabitants had also petitioned in favour of the scheme, and this was exclusive of the inhabitants of Silsden, which township had petitioned against the bill. Of the 3000 shares, already 1722 had been applied for and allotted. The Keighley Local Board of Health had petitioned against the bill, which did not touch their district at all, on the ground that they were now supplying gas by agreement to certain portions of Kildwick, and they had an application before the Local Government Board for including in their district those of Silsden and Steeton, which they believed would be granted. The *locus standi* of the Keighley Board had been allowed with respect to Steeton and Silsden, no doubt because of this representation; but on the 20th inst. the Local Government Board wrote to the solicitor to the Keighley Board, to the effect that, in view of the great opposition manifested by the inhabitants, the Board did not propose to take further action on the petition of the Keighley Board for the extension of the limits of gas and water supply. The committee held the power of determining whether, under the circumstances, the Keighley Board had any *locus standi* whatever. In the petition was an allegation that Silsden wished to be supplied with gas from Keighley, whereas Silsden now appeared before the committee, and applied that they might supply themselves—very wrongly, no doubt, but still such was the fact—and it was unreasonable to suppose that profits made by supplying Silsden with gas were to be expended in beautifying Keighley, if that town was susceptible of such an operation. He contended, in any case, that the proper principle was to let companies supply the gas, and let the local authority look after the companies. The Silsden Local Board, being the urban sanitary authority, contended that they could more advantageously supply their own district with gas than could be done by the promoters of the bill; their scheme, however, proposed to afford 12-candle gas against the promoters 14-candle gas each fixing the maximum price limit at 6s. per 1000. The Silsden Local Board had made an application to the Local Government Board of a similar character to that of Keighley, and he had been told that they had received a similar reply.

Mr. Littler said he had ascertained that the reply simply was to the effect that the Local Government Board declined to interfere with the functions of Parliament; but would be prepared to consider the matter, should the committee determine to exclude Silsden from the scheme. The Board did not interfere to prejudge the decision of the committee.

Mr. Richards said he was sorry to find that the opposition of Mr. Samuel Watson had not been withdrawn. He was a millowner at Kildwick, and was a gas-maker on rather a larger scale than the other millowners, supplying some consumers in Kildwick, including the church. It was natural enough that Mr. Samuel Watson, having got his few pipes in the neighbourhood of Kildwick, wanted to keep everybody else out; on this ground he actually asked the committee to throw the whole bill out. There was a clear, plain necessity for supplying the neighbourhood with gas, and the opposition raised was not of a character to give much weight to the petition. His interest was of an infinitesimal description, and probably all he wanted was that the company should buy his mains and pipes. If he showed a reasonable disposition in the matter, that could probably be arranged. The company would be perfectly willing to pay him a fair consideration for the money he had laid out. With regard to Keighley, he (Mr. Richards) objected to the *locus standi* of the local board, and should maintain that his learned friend, Mr. Clerk, was not entitled to be heard on their behalf.

Mr. Clerk said it was very rare for a question of *locus standi* to arise before a committee at the present time, there being a special tribunal appointed for the disposal of such questions. No doubt the case might arise in which the ground for granting a *locus standi*, when a bill was before the referees, had

entirely disappeared when it came before the committee. His learned friend said that one of the grounds urged before the referees was, that the Keighley Local Board were applying to the Local Government Board for power to include, not the whole of Silsden nor the whole of Steeton, but a very small portion of each district. Now, the board had the power to supply the whole of the area marked yellow on the map, with the exception of those parts which extended into Steeton and Silsden. They sought power before the Local Government Board to extend the area of their district as a local board, which at present was confined to about a mile round Keighley; but their power of supplying gas was not so confined. They believed the Local Government Board would assent to it, but it appeared that a letter had been received from them to the effect that they were indisposed to do so. They stated also that they did not, "as at present advised," see why the gas limits should be extended. But probably, when they were informed, as they would be the next day, that the body to whom his learned friend, Mr. Richards, had alluded as objecting to that supply, had actually entered into an agreement with the Local Board of Keighley to take gas from them in bulk at a fixed price, they would come to a different conclusion.

Mr. RICHARDS said the local board had no power to supply the manufacturers at Keighley and Silsden.

Mr. CLERK maintained that, under the Local Government Act, sec. 161, they could do so.

Mr. RICHARDS said that power applied only to the public lamps.

Mr. CLERK said where there was no other person or company supplying gas in a district, the urban authority could supply gas for both public and private purposes. The Local Government Board, "as at present advised," thought the expense of the necessary inquiry would be so great as not to justify their assent; but in that they were entirely mistaken, as would appear when the Silsden case was argued. If Silsden was excluded from the limits of this bill, and an Order was granted to the local authority there, they would have the power to purchase their gas from the Keighley Board at a cheap rate, which was the thing they desired to do. As a matter of fact, however, he contended that the decision of the referees had settled the question of *locus standi*, that there were no valid reasons for altering their decision on account of any change that had taken place in the circumstances of the case.

Mr. BONHAM-CARTER said the *locus standi* granted by the referees was not general, it only related to the townships of Steeton-cum-Eastburn and Silsden.

Mr. RICHARDS, in reply, said the argument of his learned friend before the referees was that, being before the Local Government Board with an application that might be successful, Parliament ought not to be asked to anticipate the decision of that department, and, therefore, the petitioners ought to be heard against this bill. With regard to his friend's proposition respecting the supply of gas to Silsden in bulk, he would point out that, under the general Act referred to, they had no such power. The 161st section said: "Any urban authority may contract with any person for the supply of gas or other means of lighting the streets, markets, and public buildings in the districts, and may provide such lamps, lamp-posts, and other materials and apparatus as they may think necessary for lighting the same." But they had no power to go beyond that. They could not supply gas to a shopkeeper or private gentleman resident in the place. Parliament never intended that local boards were to become manufacturers of gas, and were to go into other districts and make profits by supplying gas there. It was not like the supply of water. In that case the local authority might agree with an adjoining district to give them a supply in bulk to distribute as they thought fit. But as to gas they could not even supply private consumers in their own district; they could only supply it for public purposes, except they first obtained a Provisional Order authorizing such a proceeding.

Mr. BONHAM-CARTER asked Mr. Clerk if it was his contention that under the Public Health Act, 1875, a local board could erect a gasholder, buy gas in bulk and distribute it, and so become a sort of retail dealer in gas?

Mr. CLERK said most undoubtedly it was. If there were no company in the district, the local authority might supply gas for public and private purposes. If they could buy it in bulk cheaper than they could manufacture it themselves so much the better.

Mr. BONHAM-CARTER: Surely not without a Provisional Order?

Mr. CLERK: Yes; in this case it is an unopposed Provisional Order.

Mr. RICHARDS said it could only be done under a Provisional Order, and that was just what Keighley had not got. If, as his learned friend said, they were actually supplying gas outside Keighley and Steeton at the present moment, they were acting without any sort of authority; but, in fact, they were not doing it. What they were doing was simply this—they supplied up to the border of their district, and from that point the Midland Railway conveyed the gas, through a pipe of their own, to the Steeton station.

Mr. CLERK said that was only one case.

Mr. RICHARDS said if they were supplying in any other way they were transgressing the law.

The room was cleared, and after a short time the parties were again called in, when

The CHAIRMAN said the committee were of opinion that the Keighley Local Board had no *locus standi*.

WEDNESDAY, APRIL 26.

At the sitting of the committee this morning, Mr. RICHARDS read a letter which the Silsden Local Board had received from the Local Government Board, in reply to an application for a Provisional Order to allow them to manufacture their own gas. The letter stated that the Local Goverment Board had learned from the report of Major Tulloch that the plans and estimates drawn up by the Silsden Board were crude, and that no evidence had been submitted at the inspector's inquiry enabling the inspector to judge of the proposed undertaking as an engineering scheme. Under these circumstances, and in view of the fact that there was now a bill before Parliament proposing to supply the whole parish of Kildwick, the Board were not prepared to grant a Provisional Order; but, in the event of this bill not receiving the sanction of Parliament, the Local Government Board would be prepared to consider any further application from the Silsden Board on being furnished with properly prepared plans and estimates.

The following evidence was then called for the promoters:—

Mr. *W. Clough*, examined by Mr. MICHAEL, said he was senior partner in the firm of John Clough and Sons, worsted manufacturers at Steeton, adjoining the parish of Kildwick. The population of that parish was steadily increasing, the people being chiefly engaged in the worsted trade. There were ten townships in the parish, which were supplied with gas by private persons, no body nor person being publicly authorized to do so. Consequently, as these manufacturers did not make gas in the summer, the supply was intermittent. The streets in Silsden were only partially lighted. He manufactured his own gas; but, in his view, it would be better and more economical for the whole parish to be supplied by one body. He was one of the promoters of the bill, and had taken 100 shares in the undertaking.

Cross-examined by Mr. LITTLER: Witness said he had not extended his inquiries to Silsden. As a commercial question, he did not think the proposed scheme would be very profitable, but it would be of advantage to the public to have a good supply of gas. He knew of no reason why Silsden should not supply themselves, if they could do so as cheaply, and he had never said he thought Kildwick should compel Silsden to join this undertaking.

In re-examination by Mr. MICHAEL, witness said there was no power in the bill to compel Silsden to take the proposed company's gas, unless they chose to do so.

By the COMMITTEE: The estimate of £30,000 was based on the expectation that Silsden would have to be supplied. There were more mills in Steeton alone than in Silsden.

Mr. *Joseph Bottomley*, partner in the firm of Messrs. Samuel Bottomley and Sons, plumbers and glaziers, Cross Hills, examined by Mr. MICHAEL, said he employed, on an average, 50 workmen, and obtained his gas from Mr. Tetley, of Junction Mill. He was satisfied with this supply, except as to the price; but he thought the proposed scheme would give a better gas supply than that obtained at present. He went round with the petition, and he was only refused two signatures. He and his two brothers had taken five shares each in this scheme.

Cross-examination by Mr. LITTLER: His brothers both lived in the district. The price he paid at present for gas was 6s., which was the maximum price in this bill.

Mr. *W. Hartley*, examined by Mr. MICHAEL, said he was a worsted spinner at Sutton, and employed 150 people. He made his own gas, but did not know what it cost. He supplied one other mill, but intended to take the gas of the company if the bill passed. There was one other millowner (Mr. Bairstow) making his own gas and supplying some houses, but he had signed the petition. At present there were something like 19 series of gas-works to supply the whole parish with gas, and it would be of great public advantage to have the supply in the hands of a company.

By Mr. LITTLER: He had taken no shares in the new scheme, but he would take the company's gas if they supplied it cheaply; though it might be a question with him whether, if they charged 6s., he would not continue to manufacture for himself. Mr. Wright (the solicitor for the bill) had asked him to support the bill.

By the COMMITTEE: He supplied another manufacturer with gas, for which he charged 6s. per 1000, which was the price at which gas was generally sold there. He supposed this covered the cost of making it.

Mr. *T. Aked*, examined by Mr. RICHARDS, said he was a partner in the firm of Aked and Co., of Farnhill, worsted spinners. Farnhill and Kildwick adjoined, and were practically one large village. He employed about 70 people, and consumed 200,000 cubic feet of gas per annum. He obtained it from Mr. Watson. The quality was very fair, but he did not know its illuminating power. They used it for wool-combing, as well as for lighting purposes. He was in favour of having a company established for supplying gas under parliamentary regulations, and he believed that was the general feeling. There was one other millowner in his neighbourhood who made gas for his friends. As far as he knew, all the millowners in Farnhill were in favour of the bill, except Mr. Watson.

Cross-examined by Mr. LITTLER: He paid 5s. 6d. per 1000 at present for gas. He had taken no shares in the Kildwick Company, and was not a promoter in any sense.

Mr. *Robert Havers*, a partner in the firm of Middleton, Ainsworth, and Co., worsted manufacturers at Cononley, employing 320 workpeople, and making their own gas, was the next witness. He said they had three retorts. No account was kept of the cost of making the gas. His firm would prefer taking their supply from a company. There was no gas at Cononley except what they supplied—not even at the railway-station. The feeling of the inhabitants was in favour of the bill.

Mr. LITTLER: You have no gas at Cononley at all at present; but if it were a question between having the supply in the hands of a company, or in the hands of the local authority, and so saving the rates instead of providing for a 10 per cent. dividend, which would you prefer?

Witness: Of course, I would rather save the rates.

Mr. LITTLER: And I suppose you do not wonder that Silsden prefers not having a company, when their own board wish to supply gas?

Witness: Certainly not, if they wish to have it.

Mr. *William Binns*, of Lower Bradley, worsted manufacturer, examined by Mr. MICHAEL, said he employed 150 people, and used 340,000 cubic feet a year. The general feeling of the people of Lower Bradley was in favour of the bill.

By Mr. LITTLER: He had taken no shares in the company, and he was inclined to think that if the local board were able to supply gas, borrowing money at 4 or 4½ per cent., and devoting any profits to reducing rates, he should rather take it from them than from a company.

Mr. *John Binns*, worsted spinner at Cowling, said he made about 300,000 feet of gas a year, but he would rather buy gas than make it himself, as he wished to be rid of the bother. He supplied 50 or 60 meters, but did not know how much gas he sold in a year, as he did not keep an account, and did not know what his own consumption was. All the millowners in Cowling were in favour of the bill.

By Mr. LITTLER: There were four millowners in the township. He had taken no shares in this concern. He believed that gas would cost less from a company. He now charged 5s. 10d., but it did not pay to make gas all the year round. The district was a well-populated one.

By the COMMITTEE: He thought the people would use more gas under the proposed scheme than at present, when the supply could not be unlimited.

Mr. *Joseph Smith*, surveyor and architect, at Bradford, examined by Mr. RICHARDS, said he thought £200 would be a reasonable amount per acre for land to be taken for the proposed works.

In cross-examination by Mr. LITTLER, *witness* said he was agent for one landowner in the district in question, and he had taken 75 shares in the scheme. His interest in the bill was the prosperity of the place, as he derived considerable business from the district. He thought it would help the main scheme if it were complete, and included Silsden. The scheme originated six years ago. He did not know that it would be a very paying concern, but it would benefit the district.

By Mr. RICHARDS: The scheme was deferred on account of the rise in the price of coal. He heard nothing of the desire of Silsden to make their own gas till the prospectus of this concern was issued, about two years ago.

By the COMMITTEE: Except in a portion of Silsden and a portion of Cross Hills, the roads and streets were not lighted, and strangers could not make their way alone from the stations at night.

Mr. *Eli Milnes*, examined by Mr. MICHAEL.

I am the senior partner in the firm of Milnes and France, architects, Bradford. I prepared the plans and estimates for the proposed works. I have had experience in the construction of gas-works both public and private. I superintended the construction of the North Bierley, and of the Clayton, Allerton, and Thornton Gas-Works, in the vicinity of Bradford, and am now engaged in enlarging and almost reconstructing the works at Pudsey, near Leeds. I was employed by the promoters of the Clayton, &c., works in 1864, and got up the evidence necessary for the application to Parliament; but the bill was subsequently unopposed. That district very much resembles the Kildwick parish, the population being very scattered. It is a more hilly district and a little more densely populated in proportion to its area. The shares were issued at £10, and are now at a premium. The price of gas there varies from 3s. 6d. to 5s., the average being about 4s. 3d. The dividends of the company have gradually progressed, and are now 7 per cent. The works were opened about 15 or 18 months after the company were established in 1864. There were a large number of gas makers in that district, but, without an exception, they have all, wherever they are within reach of the company's pipes, ceased to make their own gas, and now take their supply from the company. I know the

district of the Kildwick parish (described on the map); it is favourable to the supply of gas. The site of the proposed works is the lowest in the whole district and the most central. At present the district is very insufficiently lighted. The millowners supply themselves, and they light a few houses and buildings in their neighbourhood. Some parts are almost entirely without any supply. There are three railway stations, two of which are lighted with gas, and the other with oil lamps. Steeton station takes its supply of gas from a gentleman named Tetley, at Keighley; Cononley is lighted with oil. The area of the parish is 22,534 acres, and the population 12,522. There are 6 churches, 24 chapels, 15 schools, 11 public buildings, 22 worsted mills, 7 other mills, 83 workshops, 128 other shops, 23 public-houses, 5 beer-houses, and about 2772 dwelling-houses. There are 20 gas-works, 19 of which belong to millowners, and one to the owner of a private mansion. Of these 13 have signed petitions in favour of this bill, as also have a great number of the principal inhabitants. I believe gas could be better made by one large company than by several small makers. The works proposed by the bill will be a great advantage to the district. It would injure the scheme to sever Silsden from it, because we should not then be able to supply gas so cheaply to the rest of the district. It would also be a disadvantage to Silsden itself. I believe the works can be constructed for the sum estimated, and that they will be sufficient at present for the requirements of the district. The nominal capital of the company is £30,000, and 1722 shares have already been taken up. There wil lbe no difficulty in raising the remainder of the money.

Cross-examined by Mr. LITTLER: It may be that Silsden can be supplied with gas in bulk at 3s.; but I should not recommend our company to undertake to do such a thing at present. I think, however, we could do it at the existing price of coal. I have taken 100 shares, and altogether there are about 400 taken in the district. At the meeting of the Silsden Local Board we attended to ascertain their feeling about this scheme, they told us they preferred being by themselves, but afterwards they went and made an agreement with Keighley.

Mr. LITTLER: If you will supply us as cheaply as Keighley will, we will take our gas from you.

Re-examined by Mr. RICHARDS: The Silsden scheme was entirely given up when they made an arrangement with Keighley. We could supply gas as cheaply as they could; indeed, we have an advantage over them, being nearer to Silsden. There is nothing in this bill that would be a hardship on Silsden.

By the COMMITTEE: We propose commencing with a make of 50 million feet per annum. If we lost Silsden, it would reduce the area of our supply by one-third or one-fourth, and we could not sell gas so cheaply. Keighley is a larger town, but they do not supply a larger area than we propose to supply. The consumption, however, is very much greater; the population is more compact, and there are a large number of manufactories, machine-shops, &c. They now probably make 70 million cubic feet of gas a year, and are supplying it at 3s. 2d. per 1000. The gas-works at Bradford are in the hands of the corporation. They charge 3s. 4d., but the price is about to be reduced 2d. If we start with a make of about 25 millions, at the present price of coal we could charge 4s. 3d., and pay 5 per cent. dividend. Until the consumption increases, we could not pay 6 per cent., but for some years I do not expect more than 5 per cent. The price of good gas coal is now 15s. per ton. Our estimate for works is—for buildings and furniture, £6000; for plant and tank, £9000; land and legal expenses, £2000; mains, £7000; meters and services, £2000; other works, parliamentary, and other expenses, £4000. We should begin with six or seven benches of retorts—42. Our estimate includes erection of retort-house of a capacity large enough for 100 retorts—at all events, 84—which would ultimately make 100 million feet of gas per annum.

Mr. *Alfred Penny*, examined by Mr. RICHARDS.

I am a civil engineer, carrying on business in Abingdon Street, Westminster, and have been engaged in the construction and management of gas-works for 25 years. I have been largely engaged as valuer of gas-works, and am myself the lessee of such works, both in England and abroad. I have visited the district proposed to be supplied by the Kildwick Parish Gas Company, and went to every mill and almost every inhabitant in the ten townships named in the bill. I know the two alternative sites, and recommended the Kildwick site to be adopted. In my opinion there cannot be a better; it has every qualification necessary; it is at a good level, is near to the railway, and is so situated that the works cannot be a nuisance to any one, as there are no houses near it. When I visited the district I did not hear from a single individual anything but expressions of approval of the company and a desire that they would begin to supply gas as soon as possible. I saw all the proprietors of the mills who make their own gas, and supply their neighbours. They let their neighbours have gas so long as they have it themselves. It must be a great inconvenience to these people who have fitted up their houses, relying upon a supply, to find the gas cut off at any particular time. We propose to give 14-candle gas, which is the ordinary quality, and the maximum price will not exceed 6s. per 1000, which is a reasonable price; but it by no means follows that the company intend to charge so high as that. The maximum price of gas is fixed with reference to the possibility of a rise in the price of coal. With reference to the quantity of gas likely to be supplied in this district, I have considered that it will be about 25 million cubic feet per annum at first; but the whole of the works are planned, so that with a small expenditure the production may be doubled. I have advised that the main-pipes should be laid down so as to be capable of supplying quite double the quantity estimated for in the first instance, and the rest of the apparatus to be of such a size as to make 50 million feet of gas per annum without any further expenditure. I have made gas in small works with a consumption of 10 millions, and I have made gas in works where the consumption was 100 millions. I have also been lessee of large works, in which all the details have been under my management, and I say unhesitatingly that the production of gas on a large scale may be done more economically than on a small scale. In this case I think it would be a great misfortune for any part of the district to be left out. I am certain that the inhabitants of Silsden will be able to get gas more cheaply from us than if they manufactured it themselves.

Mr. RICHARDS: You are aware that they have abandoned their intention of manufacturing gas for themselves.

Mr. LITTLER: Do not say that.

Witness: They talk of an agreement to take gas in bulk from Keighley. I should be prepared, if I were asked, to advise our company to supply Silsden with gas in bulk at 3s. per 1000—*i.e.*, that the Silsden people should erect a meter on their boundaries, and provide their own pipes, and pay us 3s. per 1000 for the quantity of gas registered by that meter. I would do that distinctly. This would, of course, somewhat depend upon the cost of coal, &c.; there should be some agreement as to a sliding scale.

Mr. RICHARDS: You would be prepared to recommend the Kildwick Gas Company, in the event of the bill passing, including Silsden, to supply that township with gas in bulk, charging them not more than 3s., if they took 3 million feet per annum, or 3s. 3d. if they took less than 3 millions, coals being taken at 13s. 6d. per ton?

Witness: Yes.

Mr. RICHARDS: And 3d. per 1000 feet to be added to or deducted from those prices for every 2s. 6d. added to or deducted from the price of coal?

Witness: Yes; and I should be prepared to go further than that. As a lessee of gas-works, I should be prepared to take these works on lease, and undertake to do the work myself on these terms, paying the shareholders a reasonable per centage.

Examination continued: I am not prepared to say that our works are in a position to supply Silsden better and more cheaply than Keighley. I only say what I am prepared to recommend the company to do, and what I would do myself. I can see no reason, however, why Keighley should be better able to supply Silsden than we could—none whatever.

Mr. RICHARDS asked the committee to adjourn the inquiry for a few minutes to enable the parties to consult. The promoters were willing to give Silsden the same terms as were offered by Keighley, and he did not think they need trouble the committee much more.

After a brief interval, Mr. RICHARDS stated that the parties had arranged everything between themselves, except with regard to the question of costs. His clients did not see any reason why they should pay the whole of the costs of the Silsden Local Board, which amounted to £150; but they thought it was a case for mutual agreement. It was not a case in which his clients had been entirely defeated and Silsden entirely triumphant. The Silsden Local Board got what they wanted, and the gas company conceded what they were willing to concede. He would, therefore, ask the chairman to act as arbitrator between the parties.

Mr. LITTLER said the Kildwick Company had compelled his clients to come forward as opponents to their scheme, and they asked that they should be put in the same position as they would have been under their arrangement with Keighley. A clause had been offered by which the opposition might have been got rid of. The local board were a public body, entrusted for the first time, under the Act of 1875, with larger powers in respect to the supply of gas than they had before, and they were in a position to go on and do so. He said nothing about the Provisional Order. The committee had heard the letter read, which stated most distinctly that, in the event of Silsden being excluded from this bill, the Local Government Board would consider the application of the local board. With reference to the question of costs, his clients were prepared to take the personal decision of the chairman.

The room was then cleared, and on the parties being recalled,

The CHAIRMAN said, in his opinion, the costs should be limited to £120, and the committee had decided that the preamble of the bill was proved.

FRIDAY, APRIL 28.

The clauses were proceeded with.

On clause 23 being read,

The CHAIRMAN said it appeared to one member of the committee that this clause, giving compulsory power to take land, was unusual. He called attention to an observation in the opening speech of Mr. Richards, in which he referred to the terms here employed, and said that, though compulsory in form, the power was not so in reality, but had been necessitated to enable the parties, having a life interest in the estate, to effect a sale. The committee wished to have this assertion proved.

Mr. *Henry Wright*, solicitor to the promoters, proved the peculiar circumstances of the tenure of the land.

The clause was then passed.

On clause 28, relating to the maximum price of gas, being read,

Mr. *H. Wright* recalled, and examined by the COMMITTEE.

Is not 6s. per 1000 feet rather a high price?—In the Keighley district they have precisely the same limit. In the Silsden district they also asked for the same limit for gas of two candles less illuminating power. Our local board, who are also near, got 6s. 6d. as a limit two or three sessions ago.

Mr. BONHAM-CARTER: Was that an unopposed bill?—It was. The Keighley bill was an unopposed bill. I may also mention that we have a sliding scale with regard to Silsden. If coal doubles in price, we get a very much larger price for gas; but we can get no larger price than 6s. from the small consumers. Silsden has no waste—they have all the gas to distribute. We expect to make a profit out of the gas at the present price; but if coals get to double the price, we shall get a much larger price.

Mr. BONHAM-CARTER: It is rather high with coal at 14s. per ton.

Mr. BELL: It is the maximum in the adjoining district.

Witness: We, of course, are limited by the Gas-Works Clauses Act as to the rate of dividend.

Mr. *A. Penny*, further examined.

Mr. BONHAM-CARTER: What do you say to the proposed maximum?—I think that 6s. is more a protective rate than a rate that will ever be charged. There is no intention whatever to charge it; but if we have such a time again as we had three years ago, it will be a very useful figure. The Gas-Works Clauses Act will operate so as to prevent such a charge as the maximum price, except under certain conditions.

Mr. *Wright:* You will bear in mind that this is but a small company, and this price is only the maximum. We do not wish to come again to Parliament at a ruinous cost.

Mr. *Penny:* In the last two years Parliament has given a larger maximum than it had previously given by reason of these very events. Many companies have had to come to Parliament to raise their maximum price.

The clause was then passed.

The other clauses were also gone through and settled, and

The chairman was directed to report the bill to the House.

TUESDAY, APRIL 25.

(*Before Mr.* ORR-EWING, *Chairman; Col.* RUGGLES BRISE, *Lord* RENDLESHAM, *and Mr.* BROGDEN.)

STOCKTON AND MIDDLESBROUGH WATER BILLS.

(*Continued from page* 819.)

Mr. SOMERSET said it would be in the recollection of the committee that, prior to the adjournment for the Easter holidays, after he had closed certain evidence as to the site on which it was proposed to construct the Grassholm reservoir, Mr. Venables had requested that his witnesses should be recalled upon that point. To this he made no objection, and when the committee adjourned he was on the point of calling Mr. Hawksley, who, however, was prevented by illness from attending. He informed his clients, after the evidence that had been given, that if they were wrong, they should frankly say so; while, on the other hand, if they were right, they should come forward and show the committee the grounds upon which they relied. Since the adjournment, an examination had been made of the proposed site, and the result was what he now proposed to put before the committee. He thought it was only fair to the parties that they should be allowed to come forward, and either say that they were wrong, or show that they had good foundation for their statements.

Mr. VENABLES said he had no objection to his learned friend producing the results of the inquiries made by his clients, if he would allow him to do the same. Professor Anstead stated, for the first time, an objection to the foundations of the dam, as the result of some borings made two or three days previously, and after the engineers of the promoters had been examined. It was quite an after-thought, and the committee allowed him to recall the engineers; but he could not understand how, in accordance with the ordinary course of proceeding, Professor Anstead could be called back on that same point. Replications of this kind might go on for ever; but he could not object to Professor Anstead being again examined, if his learned friend would assent to them giving the result of the inquiries which they had made.

The CHAIRMAN thought Professor Anstead might be allowed to give the committee what information he had obtained, and afterwards they would hear what further evidence, in confirmation of the views which had been put forward, had been gained by the corporations during the recent examinations.

Professor *Anstead* recalled, and examined by Mr. SOMERSET.

Since the adjournment for Easter, I have gone down to the proposed site for

the Grassholm reservoir, and I produce sections of the bore-holes that have been made there. [Witness then explained to the committee, by means of a plan, the stratification of the place selected.] Below the proposed site, there is a deposit of shifting sand, varying at different points in its depth below the surface, and samples of this sand I produce. The most important of the borings made was through boulder clay for 25 feet, then there were 10 feet of silted clay, and below that 4 feet of very loose silty material. The bottom of the boring was blown up by pressure from below, and a large quantity of water came in, which filled the boring, and overflowed at the rate of about 36,000 gallons a day. We then went further, and, after going through a quantity of sand and 6 inches of stiff clay, we came into sand again, and stopped at a depth of 36 feet. I do not think that at this place a safe and substantial foundation could be obtained. I think this site would be exceedingly costly. It would be absolutely necessary, so far as I understand these matters, to go to a very great expense in many ways to prepare such a site for a bank. The sand produced to-day and on a former occasion is such as would, to a great extent, be lifted by pumps, and in this sense it is running sand, and it would entail very great cost.

Cross-examined by Mr. BIDDER: I have a record of 34 holes, including those which I put down and those which were made by the corporations people. Of the twelve put down for the company, sand was got from four—one of them being 450 yards above the line of the embankment up the river—and in two we got gravel and loose material under boulder clay, which indicates sand. The least depth at which sand was found was 31 feet, of which 19½ feet was alluvial matter. In boring, the tools are jumped up and down, and the water at the bottom of the hole may be churned, but that would not change stiff boulder clay into loamy clay. I attach importance to the water coming up from the holes, because, being above the level of the river, it showed a pressure from below.

By the COMMITTEE: We had not sufficient pipes for the sinking, or it was possible we might have gone below the sand to the solid clay. To have the trench would be costly, but there is nothing to indicate particular danger, except that the support of the clay is rotten.

Mr. *Robinson* recalled, and examined by Sir E. BECKETT.

I have lately visited the site of the proposed reservoir, and sunk two shafts, and put down twelve bore-holes. At the boring referred to by previous witnesses, the materials began to squeeze and rise up, and that could not have been from water and sand coming from above. To avoid the water in the shaft getting into the pipe, we had a tube put down to the solid bottom, and this was made sand and water tight, under my direction, so far as surface water was concerned; but the water ran in at the rate of 36,000 gallons per day at a depth of 35 feet from the surface. The water filled the shaft, and came out at the top. I consider it came from a water-bearing stratification below. We left the shaft for a few days, and in another we found a clear siliceous sand. I then put a tube down the former boring again, and last night we found sand there, which I produce. It was brought from a depth of 46 feet. It began at a depth of 39 feet, and went on to a depth of 43 feet, when there was a band of yellow clay, after which we came to sandy gravel. I think the sand extends over a large area, as we find the same thing at other holes. The clay gets rotten at a certain distance, and gets worse until it reaches the clear sand. We found loamy clay, which is largely mixed with sand. I found 8 feet 6 inches of sandy running clay below the alluvium. The loamy clay is boulder clay which has been turned over a second time, and re-deposited with river gravel. At one of the holes the water came out at the rate of 10,800 gallons per 24 hours. At another, the gravel which we touched at a former place was rising; and, in consequence of the difference of the strata, we put down other holes, which showed that the sand was connected, and, therefore, in making an embankment, it would be necessary to cut through the boulder clay and through the sand before a sound foundation could be had. If that were not done, the probabilities are there would be found a connexion between that sand and the interior of the reservoir, which would cause the water to escape, and bring down the bank. At the corporations hole, water escaped, as from some porous material with heavy pressure above it. We put down a bore-hole near one of the corporations, and found nothing but clay down to 19 feet, whereas they had found boulder at 9 feet.

Cross-examined by Mr. BIDDER: No churning at the bottom of the hole would make clay into sand. It would make hard clay into soft; but in going down we are quite able to determine whether the clay is hard or soft. I drew the inferance that at one of the holes the corporations men had come to an open porous material, from the fact that water issued from the hole at a level above that of the river, which shows that a water-bearing stratification has been cut through, with a pressure behind it, but it indicates nothing further. It shows neither gravel nor sand, but may be porous rock. I am aware that supplies of water are obtained by sinking into the sandstone rock; we have not found rock at that place. A reservoir at a place like this cannot stand on account of the sand below. The chances are enormously in favour of the sand having a communication with the bottom of the reservoir. Further up the valley, say about a quarter of a mile above the site of the embankment, I found sand cropping up to the surface. I did not point that out to Professor Anstead, though I did to several other engineers a few days before. It is shown on the Ordnance maps that the ground here gradually rolls to the river. It, however, is not sand deposited by the river, as it is some four or five feet above its level. The sand is more than six inches deep, and is, I presume, forced up by some spring. The sand appeared at other places along the side of the river, having been brought up by water issuing a short distance from the surface. So far as I went I did not observe a spring, but there is the sand with indications that it comes from below the surface. I have had no experience in constructing such large reservoirs as that proposed by the corporations. I was, however, engaged in making the Fighting Cocks reservoir, which holds 11 million gallons. We there thought we had very fine clay to deal with, but met with running sand. However, the reservoir stands, though the original cost was much greater than had been anticipated.

Mr. *James Abernethy*, examined by Sir E. BECKETT.

I am a Vice-President of the Institution of Civil Engineers, and have had considerable experience in connexion with water supply. I have visited the site of the corporations reservoir, and it was I who recommended the borings to be made. Immediately below Grassholm Mill, I observed an exceedingly open sandstone cliff, and on the side of the river is a similar cliff. Immediately below the latter I observed indications of extensive landslips along the right bank. Approaching the second embankment there were also indications of extensive landslips, which continued along the side of the embankment. I found, about a quarter of a mile from the bore-holes, indications of sand near the bank of the river, and standing upon it was like standing upon a quicksand. I suppose it would be the same as that spoken of by the last witness. It was at a higher level than the river, and appeared to have been forced up to the surface by water. The result I arrived at was that it would be an exceedingly unsuitable site, owing to the sand being liable to be moved by the action of water under the boulder clay. It would be alike costly and dangerous, and it would be very difficult to give any estimate for construction.

Cross-examined by Mr. VENABLES: There is water oozing out through the sand and running away into the river, showing that it does not arise from the river. This sand was quite isolated, there being none immediately above or below it. All the existing conditions will be materially altered when the water is impounded in the reservoir. There are extensive landslips along the whole length of the valley. The general grounds on which I consider the site is a dangerous one are the indications of these landslips and the formation of the bed of the proposed reservoir; as, before they can construct a bank, 102 feet high, they must remove the whole of this shifting ground.

Re-examined by Mr. SOMERSET: My views, when I first saw the site, were verified by the subsequent examination. When the water is impounded in the reservoir, the probability is, from this outcrop of sand, that there will be an enormous leakage. It is impossible to estimate the cost of providing against such an evil.

Mr. *Waistell*, examined by Mr. VENABLES (on behalf of the corporations).

I am a civil engineer and surveyor at Barnard Castle, and know the district well. I have been employed by the corporations to superintend the borings that have been made, and produce specimens of materials found. [Witness then, by means of the plans, described the various borings which had been made, and gave results of these borings, varying materially from those given by Professor Anstead.] The general character of all the samples produced from all the borings is very similar. They are all solid boulder clay, and there is very little difference between them.

Cross-examined by Sir E. BECKETT: I was first instructed to make borings about a fortnight ago. I did some of the former borings, and Mr. Gunn the others. I cannot understand why you should find sand in some of your borings, while we found none.

Mr. VENABLES said that, after the committee adjourned on the 6th of April, a letter was written by the town-clerks of Stockton and Middlesbrough to the company, making an offer to purchase; and this, together with the reply received, he would read:

Corporations Water Bill, 1876.

Stockton-on-Tees, April 17, 1876.

Dear Sirs,—We are instructed to offer, on behalf of the Corporations of Stockton and Middlesbrough, to purchase the undertaking, including all the company's property and assets, of the water company, on the following terms:—

1. By annuities secured on the revenue of the undertaking and the rates of the two boroughs, to constitute a first and irredeemable charge on the former, and amounting to £18,647, the present maximum statutory dividends, or to pay the capitalized value of the same at such number of years purchase as shall be fixed by the committee, or by an arbitrator to be appointed by the committee.
2. By payment of the statutory debt of the company.
3. In addition to the statutory debt of the company, the corporations to relieve the company of all their other debts and liabilities, the amount thereof to be determined, in default of agreement, by an arbitrator to be appointed by the committee.
4. The corporations contend that the above payments cover everything to which the company would be entitled; but if the committee hold that the company is entitled to any further payment, the corporations agree to be bound, both in principle and as to the amount, by the decision of the committee. If the committee decline to assess the amount, if any, of such additional payment, the amount to be determined by an arbitrator on such principles as the committee shall define.

As an alternative, the corporations are willing still to adhere to their original proposal of an open arbitration.

We request an answer at your earliest convenience, and we are to state that the Corporations reserve to themselves the right of submitting the above proposal, if not accepted by the company, to the committee.

(Signed) H. G. FABER, Town-Clerk, Stockon-on-Tees.
J. T. BELK, Town-Clerk, Middlesbrough.

To Messrs. Hugh Dunn and Watson, Solicitors, Darlington.

Water Bills.

Darlington, April 20, 1876.

Dear Sirs,—We beg to acknowledge the receipt of your letter of the 17th inst.

Your clients are already fully aware that the water-works company are not disposed to sell their property, and they certainly do not acknowledge the right of the Corporations of Stockton and Middlesbrough to take their undertaking from them under the compulsory powers contained in the bill you are now promoting in Parliament. The company cannot believe that Parliament will do what it has never done before—that is, take away and confiscate private property, simply because your clients are coveting their neighbours goods. You are well aware the company has been struggling for a quarter of a century when neither Stockton nor Middlesbrough would invest 1s. in supplying the district with water, and for a great part of that period earning a very scanty return on the capital invested. The proposal now made by you, that your clients should appropriate to themselves, without any compensation or value, the entire results of a quarter of a century's toils and difficulties, monetary and otherwise, is so absurd that we need hardly say it is declined.

We must, in conclusion, protest against letters being written us for the mere purpose of being read to the committee on the bills; and it seems to us that your letter must be regarded as rather an attempt to thwart the fair hearing of the case we are now submitting to the committee, than as a practical proposal of a business character.

(Signed) HUGH DUNN AND WATSON.

To H. G. Faber, Esq., and John T. Belk, Esq.

WEDNESDAY, APRIL 26.

Mr. *Thomas Hawksley*, examined by Sir E. BECKETT.

I have executed quite a hundred water-works of from very large down to a very moderate size, both in England and abroad. I am not the engineer for the Stockton Company except for purposes of construction. I have nothing to do with the management, nor have I been called in to make any report upon the subject-matters which are now before this committee, but I have mentioned now and then to the managing directors what my views and opinions are. I had nothing whatever to do with the correspondence read by Mr. Bell earlier in these proceedings. I knew there had been some, but was not acquainted with what it was till I heard it read here. I have no kind of responsibility for what was read, for when asked to advise the directors upon a question which had been raised by the corporations, I did so in terms which Mr. Bell did not read. I was consulted upon some point with reference to the corporations proceedings, and I advised that the directors were not in a position to make any advances to the corporations. I also advised the water company, or rather the directors, that in the very difficult position in which they had become placed by the rejection of their bill of last year, they should this session promote two bills—the first for continuing their works in the manner proposed, and for acquiring further powers to take the additional quantity of water required from the Tees; the other for the construction of a tunnel, to enable them to take additional water from higher levels. My reason for wishing them to promote two bills was simply because the water at Tees Cottage, notwithstanding everything that has been said against it, is undoubtedly most excellent water; therefore, except on a question of prejudice, there is no reason why they should go elsewhere. But I told them that there was a strong prejudice upon the subject which had grown up, not in Darlington only, but in Stockton and Middlesbrough, and that, therefore, the better way, in my opinion, would be to bring in an alternative bill, with higher charges, to meet the greater expense which would be occasioned by taking the water from the higher levels, and to do in point of fact, in substance, that which the corporations are proposing. I told them that the cost would be enormous, as it will be; but that if it were the pleasure of Parliament to require them to do it in order to remove the prejudice, they ought to undertake the scheme. That is still my opinion, and I would advise more than that. They have now a surplus income, and if everything goes on well they would soon be enabled to reduce the charges to Stockton and Middlesbrough, but I would recommend them, instead of doing this, to keep to their present prices, and appropriate the additional amount to new works in the higher districts. These would not cost the enormous amount proposed by the corporations, but would be sufficient for the supply of the additional quantity of water which it has become necessary to provide for the district. That appears to me to be the better and cheaper way. The difficulty in considering matters lies in this—it is important to the iron-masters that they should have their water at a very low rate. The whole of the water is now sold at an average, both for trade purposes and for ordinary consumption, of 3½d. per 1000 gallons. There is not such another instance as this in the whole kingdom, and it is a great advantage to Middlesbrough. If the works are made which the corporations propose, this low price will cease, for no gravitation works made under the circumstances under which these will be made can supply water below 7d. per 1000 gallons. In the present case, taking the offer read yesterday to buy up the company at £18,000 a year, they might be able to charge something between 7d. and 9d. They could not do it under 7d. It is said that the corporations will charge the ironmasters only the present rates,

but if they do, the remainder of the burden, inasmuch as the ironmasters will be paying directly less than the fair price of the water, must be cast upon the general district rate, and the ironmasters, who are the great rateable people, will have that money to pay in another form—that is to say, in increased rates charged by the corporations to make good the deficiency. That is of constant occurrence, and, if necessary, I could give plenty of instances. The directors considered my representation, and they came to the conclusion that it was best for them to promote only one bill, and resolved to keep their present supply at Tees Cottage, leaving it to the committee to put any obligations upon them which they may think fit. The company will in any case have to come to Parliament again in a few years, and supposing they do so come without having first done those things which may be imposed upon them by this committee, and which they have pledged themselves to carry out, they will have no chance at all of obtaining any further powers from Parliament. I think the company ought to consent to clear the river of any sewage, and they ought, if necessary, to agree to a proviso being added to the clause, enabling them to take further water from the Tees, to the effect that they shall not take any such further quantity of water from the river unless and until the entry of sewage into it has been prevented.

Sir E. Beckett said he might here remind the committee of the resolutions of the water-works company, which had previously been read, agreeing to apply for injunctions to restrain Barnard Castle and other places from emptying their sewage into the Tees; and, if they were allowed to take additional water from the river, to construct a compensation reservoir above the intake, and deliver, in dry weather, from such reservoir, a quantity of water equal to that which they were empowered to take in excess of their present powers, and further to include Yarm in the area of supply.

Examination resumed: Those propositions meet with my approval, and there is no difficulty in carrying them out, as there is power given by the Public Health Act of last year (clause 63) to do things of that kind without the necessity of direct legislation. I do not see that there would be any difficulty in supplying Yarm. It is a mistake, although a very common one, to charge separate supplies as a separate consumption. I think that corporation supplies, as is done in several cases within my own knowledge, ought to be aggregated for the purpose of charging as a whole, and that they ought to have their water at the same rate as the ironmasters. Assuming the river to be purified by injunction, the supplies to be increased as suggested, control to be put upon the company against taking more water from the Tees until they have made compensation reservoirs, none of the alleged grievances will remain. The domestic supply is at present about 25 or 26 gallons per head per diem. That is a great deal too much, and is just about double the quantity which is actually used in all the great towns in the kingdom where proper regulations with regard to fittings are enforced. Liverpool is only introducing at the present moment regulations for controlling fittings, and with remarkable benefit, as there is a reduction there amounting in many parts of the town to as much as one-third of what was previously used. In Manchester, the domestic consumption is only 13 gallons per head; in Nottingham, 15; in Norwich, 13; in Sheffield, where the pressure is enormous in some parts, they have been enabled to reduce the consumption from 40 gallons per head to 18, and, deducting 3 for trade purposes, to 15 gallons for domestic consumption. I may mention that all these are instances of constant supply on the best principle. People can draw any quantity of water they please at any moment, day or night; all that has been done having been simply to prevent useless waste down pipes and water-closets which were of bad construction, and which simply sent the water back unused. For trade, about 34 or 35 gallons per head are required of the Stockton and Middlesbrough Company. The quantity taken last year amounted to that, but we are now only delivering 47 million gallons per week, and we have 13 million gallons to spare. We could save 7 million gallons of the waste, and would then have 20 million gallons to spare. If trade revives, we shall require 7 million gallons more per week; so that we shall have 10 million gallons per week to spare if we take 50 million gallons as the amount required. So far as money goes, it would be to the advantage of the corporations and the ironmasters to let us take as much water from the Tees as possible. The Tees is so large a river that we did not anticipate any opposition to the proposal of last year to take an unlimited supply. There is no interest below the company's intake that will be injuriously affected by taking more water. There is only Dinsdale Corn Mill, which the company are willing to purchase or compensate for. It is a small mill, and very little used. Connected with it is a weir, which has been the subject of a great deal of contest with the Tees Fishery Board. It is 7 feet in height, and if removed it will not have to be taken into consideration, for the fish will pass up without difficulty. As regards the scour of the river, the ordinary flow of low water is not affected by the abstraction of water at all. The scour which affects the river is that of the floods, which amounts to 8000 million gallons per day passing our station. That is equal to 800 days use of water for Darlington and ourselves, and the one day's flood water would supply us for over two years. The average flow of the river is 350 million gallons per day, and the two works of Darlington and the company only take about 10 million gallons. The minimum flow is about 40 million gallons per day, but in exceptional years it may possibly have fallen below that for a short time. I do not think that to take 30 million gallons more per week will do the river any harm. Neither the millowners nor the conservators will suffer. As to the conservators, it goes back to the river in the shape of sewage, which is just as good for the scour of the river as the water itself. To give compensation water above Tees Cottage for the amount taken at that point, would leave the quantity below precisely as it was before. No doubt a compensation reservoir would make the river above the pumping-station better. The sewage comes in at Stockton and Middlesbrough, except the Darlington sewage, which comes in by the Skerne, and is what the Darlington Corporation have taken from the river. The corporations have taken my scheme bodily, and copied the errors. They have made it more expensive, and will not get through it under £2,000,000. They propose to construct works at an expense of £700,000, but they are only works shown on the deposited plans; besides which they will have to construct other large reservoirs to make them effective. The drainage area is not 29,000 acres, as they say, but about 30,500. That has been accurately ascertained, and the exact boundaries of the watershed. The rainfall is 48 inches at the mean level of the watershed. The uniform rule for ascertaining the available quantity is to take off the produce of wet seasons which cannot be restored, which will be 8 inches; evaporation, 14 inches; leaving 26 inches of available rainfall, which gives 48¾ million gallons. The usual rule is to give one-third of the quantity as compensation to the stream, which would be 16¼ million gallons a day. Here they propose to give only 11½ millions. Not less than 170 days must be the amount of storeage to give the required quantity to the river, and that would be 4700 million gallons; but those gentlemen only propose storeage for 2700 million gallons. They must therefore make additional reservoirs, which will cost at least £300,000. Then they have another main to lay, which is not in their estimate, and would cost £194,000 at the present prices. They will also require a duplication of their service reservoirs—we have had to triplicate ours—and that cannot be taken at less than £15,000. They are going to divide the water supplies, giving to the ironmasters that from Tees Cottage, and to the inhabitants another kind of water from the upper sources, so that they will require two systems of service which are not in the plans. They will require a new set of large mains for the iron-works alone. Then they have put in nothing for the distributing-pipes for the additional 170,000 people who are to take the water. It cannot cost less than £500 a mile, and that would take £20,000, for 35 miles of pipes would be required at least. Then there are all the communication-pipes, which will cost £15,000. If we take only the usual 10 per cent., it will come to more than £1,400,000. When they have done that, they will have to buy our works. I do not say what that would be, but in round numbers I state the total expense as £2,000,000, including the purchase of the works. They do not mention filter-beds in their plans, and they do not mean to make them; but the water will never be satisfactory to the inhabitants without it is filtered. We are adding about 70 per cent. to our present filtering arrangements. The water they get will be a much browner water than ours, and it will be turbid, which ours never has been, except when we made the reservoir at Fighting Cocks, and when the water has been lashed against the sides in a gale on one or two occasions. I produce samples of the water taken on different occasions. Some are those taken at the sites of the proposed corporations reservoirs, on the Lune and the Balder, and others have been taken from the domestic supply of Stockton and Middlesbrough, drawn not at the works, but from the taps. Whatever prejudice there may be against the present supply, there is an undoubted prejudice against dark-coloured water, such as is got from mountain districts. Where we pump, the water is not so dark, from oxidation having taken place. The water of Glasgow is whiter than when taken from the lake, where it is brown.

By the Chairman: The Loch Katrine water is oxidized in its flow of 35 miles, through tunnels which exclude the sun but not the air.

Examination continued: I know the effect of oxidation on sewage. From Barnard Castle to Tees Cottage the run is sufficient to destroy the sewage which enters at Barnard Castle. The oxygen of the air consumes it as perfectly as coal is burnt in a grate. Not a particle of sewage arrives at Tees Cottage, but there is a prejudice with the people which ought to be removed. The prejudice does not exist at Darlington, which takes the water at the point where we take it, and the people are unanimously in favour of it. The Darlington Corporation filter the water. No works can be made in the upper valleys by either party for several years, and the immediate wants of the inhabitants must be considered. I estimate £170,000 for our additional filters, mains, and reservoirs, with a pumping-station at Ormsby to lift the water to a higher level than that proposed by the other side. Those works will allow the company to go on for a number of years, with the extra 4 million gallons a day. We have additional crossings of the Tees, for safety purposes, so that the ironmasters on the other side of the river may depend on a constant supply of water. The North-Eastern Railway Company are going to make a large fixed bridge over the Tees, just above the present stone bridge; and their engineer says there will be no objection to our laying our mains over it, so that we can get over the objection of the Tees Conservancy. We have had great facilities for laying our pipes along the railway for 20 years, and have had no difficulty whatever. The balance of advantages is largely in favour of a company, as against a corporation, in the supply of water, as corporations look sharply after the companies, while there is no one to look after the corporations. The supply of water is always better by a company. The Stockton and Middlesbrough Company may not be able to borrow at 4 per cent. They are now paying 4½ per cent., and when they are more largely indebted, the rate of interest is not likely to decrease. The corporations must redeem the works, and a large amount of interest must be paid out of the rates for years and years before the water can be sold cheaply. The charges by a corporation are always larger than by a company, and in this case it would be enormously so. In no case whatever has Parliament ever allowed a corporation to take a company's works by force, in the absence of any agreement. The Corporation of Leicester were allowed to buy shares in the company, and afterwards, when they brought in a bill to buy the company it was thrown out. I have not gone into the question of the construction of the embankments of the corporations reservoirs, but I know what has been done at the site. I would not select such a site if I could avoid it. I have no doubt a most expensive puddle-trench will have to be made. There must be good sites on this valley, but this is not one. The Tees water is much better than the Thames water, and there has never been any evidence of disease caused by the Thames water. There are between 3 and 4 million people in the Metropolis, and it is the healthiest of all the large towns in the kingdom.

Cross-examined by Mr. Clerk: Darlington pumps its own water at Tees Cottage, but will not get the same quality as is now supplied if the compensation water proposed is turned into the river. Even though Darlington is excluded from the operation of the corporations bill, still it will be injured by the abstraction of water from the Lune and the Balder.

By Mr. Venables: No engineer can avoid compensation water being at times discoloured. The operations of the proposed works will be to do this beneficial thing—supposing it to be beneficial—for Stockton and Middlesbrough at the expense of Darlington. Considering the discoveries of coal in the neighbourhood, I do not know any river upon which bleach-works and dye-works are more likely to be established. So far as the company's proposed reservoir for compensation is used, its effect will be the same as that of the corporations reservoirs. After the undertaking given by Sir E. Beckett, the company will have to construct that reservoir; but it does not follow that it will have an equally injurious effect as the corporations scheme, as the company propose to take a smaller quantity of water. They will have to provide only 4½ million gallons, whereas the corporations propose 10 millions, which would be 16 with the compensation water required. The corporations will not be benefited by increasing the flow of the river, which is already sufficient, but they will be injured by the discoloration of the water. I produce samples of water from the Balder, the Lune, and the Tees at Stockton and Middlesbrough, taken between the 18th and 22nd of April. I do not know if there was snow on the hills around the district at that time. Of course, the melting of snow would produce a peaty appearance in the water. I object that the corporations bill does not provide for money that will be needed. There will be an immense amount of expenditure beyond the £1,200,000 provided. The compensation to be given for the water to be abstracted from the Lune and the Balder ought to amount to one-third of the quantity taken, which is the common practice. It is a proper compensation, not to individuals, but to the stream itself, and is usually observed by Parliament in passing bills. Money compensation to the millowners will not be sufficient to settle the matter, for, according to the petition of the corporations themselves, the fishery interests, and the Tees Conservancy Board, have a right to ask for the full amount of compensation water, in the proportion of one-third of that taken, to be given to the stream. My calculation of the increased cost is based upon the supposition that 16 million gallons a day will be taken, as against 10 million gallons proposed by the bill. The increased cost of £300,000 would thus be reduced to one-half that sum. The scheme of the corporations proposes to give only two-thirds of the proper compensation, and at the same time miscalculates the drainage area by 1500 acres. It is absolutely impossible to do all that is proposed by them and acquire the company's property for £1,200,000. I know that evidence has been given that they can supply 7½ million gallons a day, but there is nothing in the bill to provide that it shall be given. It would, no doubt, be an advantage to the consumers that the corporations should get all the water, but the cost of the undertaking is not fairly put before Parliament. The dry weather flow of the Lune and the Balder is as nearly as possible three-tenths of a cubic foot per 1000 acres, or between 4 and 5 million gallons, so there will require to be 170 days storeage. As to distribution, if the places along the line of pipes buy water in bulk, as is proposed, the corporations will not have to pay anything for distribution. There will have to be provided two separate systems for the supply of the Tees water to the iron-works, and of the Lune and the Balder waters for domestic consumption. It is true a line of pipes is already provided for by the bill to a certain point, but there are no reservoirs such as will be required, except the Sadberge reservoir of the company, which it is proposed to

take over. That reservoir was constructed mainly to ensure a regular supply to the ironmasters. The corporations scheme has no reservoir for that purpose. Gravitation will not provide the necessary supply without reservoirs, because the first thing in the morning the consumption is more than twice as rapid as at any other time, and in order to meet that consumption, if there are no reservoirs, pipes would have to be laid large enough for the accumulation of a sufficient quantity to meet the demand. For 160 days the Blockton reservoir will give out 3 million gallons, the Grassholm 7½ millions, the Hury 5½ millions, and the average dry weather flow will be 6 millions; in all, 22 million gallons. Mr. Mansergh's estimate is 21 millions, but that is founded on a fallacy. I have given the result of my own experience with the same amount of rainfall at about the same elevation. At Leicester, where the rainfall is less, they fail with 240 days of rain. In some cases 300 days are required. The filters will slightly diminish the bad colour of the water, but will not get rid of it. Gravitation schemes are not always worked with filters; but here the towns have become accustomed to filtered water, and they will not like to descend to the unfiltered. Ten per cent. is ordinarily allowed by engineers for contingencies, yet the corporations have not estimated for the contingency of making the trench. I did not advise the borings to be made, as I did not wish to incur the expense. If there is not sand under the boulder clay, 15 feet will be quite enough for the foundations of the reservoir. I have not read the evidence as to the borings, but the sections produced show that sand has been found. It will make a difference whether there are only pockets of sand or continuous beds, which latter there would be if water came out of the bore-holes for any length of time after they were made. Where the quantity of sewage in a stream is insignificant as compared with the volume of water, it is impossible for the matter to remain long in the water. As to buying up companies, the number of years purchase varies with the value of money, and as that has depreciated since 1867, as much as 27½ years purchase is now given. In the case of Birmingham last year the price paid was 25 years purchase *plus* other things. Where the income of a company is fixed, the number of years purchase must be extended.

(*To be continued.*)

Legal Intelligence.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

WESTMINSTER, FRIDAY, MAY 19.

(*Before Justice* BLACKBURN *and a Special Jury.*)

SUGG *v.* SILBER.

(*Continued from page* 824.)

Mr. *Imray* recalled, and further cross-examined by Mr. WILLIAMS.

I have carefully perused Sugg's specification. It says that one of the things the patent consists of is the delivery of the gas into the chamber at a low velocity, and then describes something it does not do. I have never tested the burner to see whether those results are produced or not, but am as certain about it as that two and two make four. I am familar with the use of the photometer, having used one myself very often, though not lately. I believe the burner of 1869 was a decided improvement upon the burners previously in use. I think Sugg's specification applies to flat-flame burners as well as Argands. I do not think a flat-flame burner would burn very well with an inappreciable pressure at the point of ignition, it would burn with a very small flame.

By Justice BLACKBURN: If you were to burn a certain quantity of gas per hour, say five feet, and if you have holes of a certain size, that gas must issue at a certain velocity, whatever you do to it before it gets to those holes, you cannot help yourself, and therefore you must have a pressure proportionate to that velocity, so that the whole thing resolves itself to this: what quantity you burn per hour, and what is the size of the holes?

Justice BLACKBURN: If the pressure is so reduced that the quantity of gas going through each hole is reduced to what has been called an inappreciable or least possible pressure, what effect would that have in a burner?—The same effect as in an Argand burner—it would reduce the blue.

Cross-examination continued: It would have the same effect with an Argand as with a flat-flame burner. I never measured the pressure at the point of ignition. The gas would issue from the mains to the chamber at a temperature of about 50°; it generally issues from the works at a higher temperature; but in winter it would be lower. I believe it has been tried at the gas-works to reduce the temperature to 40°; but I do not know whether the attempt has been successful. Whether the chamber is of steatite or of metal, the difference in temperature is utterly inappreciable, although I have never tried any experiments for the purpose of testing this. No doubt the steatite prevents the heat being conducted from the point of ignition, and that is a great advantage. The metal chamber conducts the heat from the point of ignition much more effectually than the steatite chamber. The fittings of the steatite chamber would also be less heated than the fittings of the metal chamber. The difference of heating is, however, inappreciable; there is no time for it to change temperature. I have not tried any experiments to see whether the effects produced are produced by the means indicated in Sugg's specification. I am aware that a large number of experiments have been made by the gas referees. I know Mr. Sugg only by reputation, and I know that he and Dr. Letheby experimented a good deal; but I do not know at what date. The bottom part of Silber's burner is exactly like Williamson's. There are no bent tubes in Silber's. One thing which I think makes a very good burner of Sugg's is, that you get a fine clear passage for the air; that is the great advantage of the bent tubes. The tendency of the three tubes is to allow the air to pass freely to the burner, and to conduct the gas in a tolerably uniform way by conducting it at three points. The three are better than two, and much better than one. The only office of the three tubes is to convey the gas without much interference with the passage of air, and to tolerably well distribute it.

Is one effect of the dish-shaped chamber of Silber's burner, supposing the aggregate area of the exit holes is less than the aggregate outlet holes at the top of the chamber, to arrest the velocity and reduce the pressure?—Certainly not; if you are to burn a certain quantity per hour you must have the same velocity.

Is it your evidence that Durich's, Johnson's, Williamson's, and Duff's specifications amount to an anticipation of Sugg's?—I did not say so. They have not got Mr. Sugg's combination.

Cross-examination concluded: I have seen Williamson's burner in use, but I cannot tell when or where. Williamson's specification would be applicable to any kind of burner; although I have never seen it applied to an Argand. I have no idea from experiment what the effect would be upon an Argand. I have never seen Durich's, nor Duff's, nor Johnson's patent in actual use. My knowledge of these is confined to what I have read from the specifications.

Re-examined by Mr. ASTON: Williamson's specification indicates perfectly clearly how the object of the patent is to be effected, and the description there gives quite as much information as Mr. Sugg's, in reference to the article made; that is, to any person of competent knowledge, and I say the same of Durich's. In my opinion there are directions given in Williamson's specification how you may reduce the velocity—if the velocity can be reduced—at the apertures of combustion, by restricting or constricting the inlet area as compared with the area of combustion. Assuming that the object is to reduce the pressure at the orifice is as much as possible, there are also directions how to effect that. In Durich's specification the directions are the same as in Sugg's, except that Sugg has put the velocity at the wrong place. I do not agree that by diminishing the area of inlet you diminish the velocity of the gas entering the gas-chamber, but the velocity at the orifice of consumption would be diminished. Beyond what is done by the three channels as described in the specification, there is nothing in Sugg's burner that I do not find in Williamson's. Williamson's has got the restriction of the entrance, the reduction of pressure in the chamber above, but he has not got the bent tubes, and I really think that is all the difference. I never experimented with a bat's-wing burner as to the pressure at the point of ignition, nor have I ever heard of any experiments of the same kind having been made with Mr. Sugg's burners, or those of others. If the area of inlet was made smaller than the area of combustion, and the gas was to be burned at the least possible pressure, that would give instructions to an average workman that he would understand. Taking the word "aperture" in the singular, and taking that direction, I do not see why that should not apply to a bat's-wing burner as well as to an Argand. Referring to the claim, the words there are such as would, in my opinion, cover all sorts of burners. If a steatite chamber was used in Williamson's patent instead of a metal chamber, there would be the same low pressure and decrease of temperature as in Sugg's Argand.

Dr. *William Wallace*, examined by Mr. MACRORY.

I am a Fellow of the Royal Society of Edinburgh, and of the Chemical Society of London. I am also a consulting analytical chemist and lecturer on chemistry in Glasgow, and am gas examiner to that city. I am the author of a paper upon the "Economical Consumption of Gas," which appeared in the JOURNAL OF GAS LIGHTING. I have experimented on the Silber burners. I took some which happened to be side by side in the same box. From one of them I took off the steatite top, leaving nothing in the way of obstructing the gas but the chamber below, and I tried how much gas that would pass at a certain pressure. The pressure chosen was about a tenth and a quarter. The reason why that pressure was selected was because it was the greatest pressure that could be obtained, and I found it to pass at that pressure 19·5 feet per hour. I took a burner and removed the bottom part of it, and took out all the obstructions, so that the gas might flow through it as through an open tube, so that there was no obstruction to the flow of gas except the holes in the steatite top, and at the same pressure it passed 16 feet per hour. The conclusion I arrived at from that experiment was that the orifices below are greater in area than the orifices above, in the aggregate.

By Justice BLACKBURN: I did not use the nose-piece in any case; I did it without a regulator.

Examination resumed: In my opinion, this was the only way of testing correctly the area of the apertures of inlet, and the area of the apertures of combustion. The apertures of inlet are not regular in their uses, or in their forms. They are more or less triangular; but that is all that you can say. The apertures of combustion, as far as I can judge, are perfectly regular, at least, as regular as those of any other burner of the same kind. I also made other experiments upon Silber's burners. One passed 18·9 feet per hour at the inlet apertures; another, 18·4; another, 19·6. As regards the inlet apertures, I did not test any more tops by themselves, because these were perfectly uniform; but I tested three burners complete to see how much they would pass per hour. I found them pretty uniform, and passing respectively 17·6 feet, 16·4 feet, and 16·3 feet, at 2-10ths of an inch pressure. I took 2-10ths in all cases, except in those cases where the inlet for the gas was so large that I could not get that pressure. I altered the pressure because I found by the inlets of three of them I could not get quite so much as 2-10ths of pressure. I tried with that pressure the inlet apertures, as compared with the complete burner, and I found that the inlets passed a greater quantity of gas alone than the complete burner in every case. From these experiments I come to the conclusion that the aggregate area of the inlets is greater than the aggregate area of the outlets. All these experiments were tried without the regulator, which is the proper way of trying them. I have given all the essential results. I compared one burner with those I took hap-hazard from the stock. It is a 40-hole burner. I tried how much gas would pass in an hour, and found that at 2-10ths pressure it would pass 14 feet. I drew no conclusion from that, except that the gas goes through it freely. I also made experiments with the "London" burner. The whole of the top of it was cut off, leaving nothing but the three tubes standing. These experiments were without the cone governor. One of the cone burners passed, with 2-10ths of an inch pressure, 5·2 cubic feet per hour. I tried another complete "London" Argand, and it passed rather more—about 5·4 feet per hour. I then tried the steatite top of the "London" Argand, provided with a crutch bottom, the three tubes being removed, and I found that it passed 7·7 cubic feet per hour; but I also found, on examination, that the holes in it were smaller than the holes in the ordinary referees burner; and, therefore, I have no doubt that Mr. Sugg is correct in stating that the steatite top will pass as much gas as the inlet. The Argand I truncated was, I believe, the ordinary referees size. I got the burners from Mr. Silber. The one from which I cut out the three tubes seems to be the same size as the perfect one. The conclusion I arrived at was that the aggregate inlet area is smaller than the outlet area, as stated by Mr. Sugg. In that respect I found that Mr. Sugg's burner and Mr. Silber's burner were quite the reverse. The two burners resemble one another in having steatite chambers with large holes. I am not aware there is any other point of resemblance. The shape of the cone is entirely different. Sugg adopted the cone of Leoni and the German burners, while Silber has adopted the cone used in a paraffin lamp; and in neither case is the cone new. The German burner has a porcelain chamber. In the Silber burner there is no obstruction to the flow of the gas. It flows through just as it would in an open pipe. In that respect there is an entire dissimilarity between them. I got three Silber burners, two years ago, and they had no regulators. The dissimilarity is this, that in the "London" Argand the pressure is obstructed or reduced by the three tubes; in the Silber burner, the pressure is reduced by the stop-cock, and not by any part of the burner itself. In the "London" Argand, the pressure is reduced by the diameter of the tubes, and must remain always the same, whereas in the Silber burner the obstruction is outside the burner altogether, and has no connexion with it. The three tubes besides being a constrictor, serve the purpose of distributors. With regard to the regulation of the air currents in the two burners, there is a dissimilarity. In Sugg's burners, the air cones are straight or slightly curved, but in all cases they are conical; whereas in the Silber burner it is a cylindrical tube, and not a cone outside the burner, and it is only slightly curved over at the top. The air cone is not part of the burner in either case. I also made experiments with flat-flame burners to try at what pressure the gas really issued at the point of ignition. I took three bat's-wing burners and one fishtail burner, which I produce. In one of Williamson's fishtails, with a regulator, burning at the rate of 5 cubic feet per hour, the inlet pressure below the regulator was 13-10ths, in the chamber it was 3-10ths. I also made an experiment with Duff's arrangement with a bat's-wing burner on the top, which is a regulator, and this burned 3·2 cubic feet per hour; the pressure at the inlet was 15-10ths: the pressure in the chamber was 2½-10ths, or in the proportion of six to one. There were other two experiments with a Silber bat's-wing, with no governor. This burned 5 cubic feet per hour, and the pressure below was 9-10ths, and in the chamber 3-10ths, or in the proportion of three to one. There was one more experiment with Silber's bat's-wing burner. Five cubic feet per hour showed a pressure of 6½-10ths below, and 2½-10ths in the chamber. The same burner, burning 3 cubic feet, had a pressure below of 3-10ths, and in the chambers 1-10th. By the pressure in the chamber, I mean the pressure at the point of ignition. The conclusions I draw from these

experiments, especially from the last, is that you can burn gas in a bat's-wing burner at a pressure from 3-10ths to 1-10th. When the pressure is below 1-10th, we say it is practically without pressure. The flame I got was a tolerably well-formed flame.

Cross-examined by Mr. WILLIAMS: I do not agree with Mr. Imray that it is impossible to ascertain the pressure in a flat-flame burner. I have made some experiments since the commencement of the trial, and have heard a good deal of evidence. The Silber burners I experimented upon were submitted to me this week. I made no examination beforehand to see whether the burners were equal. I assumed they were equal. I assumed the steatite tops were the same, but otherwise the burners were not the same. In one burner which I received two years ago I found it passed at 2-10ths pressure 14 feet per hour, whereas Mr. Sugg's under the same pressure only passed 5 feet per hour. The experiments I have made were on burners given me during the week, but not previous to 1874. I found the inlets were slightly different—not quite uniform. I compared some of Silber's burners with Sugg's to test the illuminating power nearly two years ago in Glasgow, where I have the most complete apparatus for testing. I found the illuminating power slightly superior to that produced by Sugg's. I have not tested the burners from which I took the tops for the purpose of finding the illuminating power. The conclusion I draw, however, is that Silber's is superior, and would produce better illuminating power. The burners were of different sizes in order to burn different quantities per hour. A cone screwed higher or lower would admit a greater or less quantity of gas into the chamber. If fixed to a washer it would be permanent; but in Silber's burner, that has no washer, the cone is loose. Mr. Silber does not provide any means of checking this. If the cone was properly adjusted it would be rendered permanent for regulating the gas. I do not know whether the cone in the Silber burner is to dispense with the use of the stop-cock. I would not use it for that purpose. If the cone was super-added to the ordinary stop-cock, the valve ought to be adjusted permanently; but it is not so, and I think this is a defect in the Silber regulator. The addition of a washer would remove this defect, and the cone would become a permanent regulator for controlling the inlet of gas to the burner. Before 1869 I had not much connexion with gas matters. I know that Sugg's burner was a great advance on the old burners, and I agree that he took the gas world by surprise by his invention, for the reasons stated by Mr. Stevenson and others. Mr. Silber's burner was also a great improvement on the old burners, and the same result is obtained as from Sugg's Argand, but in a different way. It is an admitted fact that all the burners that give the best results have steatite chambers, but I do not know whether it is the diminution of the heat or the enlarged size of the holes that produces the good effects. The gas passes both in and out of Silber's burner at an inappreciable pressure. I know this from experiments I have made. The pressure would be also inappreciable throughout the whole chamber.

Re-examined by Mr. ASTON: The regulator in the Silber burner is the same as was used in the Williamson burner. I cannot say whether regulators with washers were used prior to 1869. The inlet area of the burner that consumed 5 feet, would be less than the area of the 14-feet one.

Mr. *Frederick J. Bramwell*, examined by Mr. ASTON.

I have had considerable practice as a consulting engineer, and am Past-President of the Institute of Mechanical Engineers, a member of the Council of the Institution of Civil Engineers and Fellow of the Royal Society. For many years past I have paid attention to gas apparatus and to the use of gas for lighting purposes. The improvement in the plaintiff's specification consists of the delivery of gas into the chamber containing an aperture or apertures. The meaning of the word "aperture" as applied to gas-burners, would imply a burner like the bat's-wing which has a single aperture, or a jet-burner with a single aperture. I do not know of any other means of specifying an aperture. It appears to me that the plaintiff has used one of those guarded expressions a patentee employs in order that he might not put his restrictions on other burners which are probably adopted.

Assuming that in a burner having an aperture, it is desirable to reduce the pressure so as to give it the least possible pressure, what meaning would you attribute to the words "least possible pressure" as applied to a bat's-wing burner?—Such a pressure as would give an efficient and useful flame; a pressure that would prevent blowing, but not such a diminution as would prevent the flame being a useful flame. If it was reduced to a very low pressure when there was a current of air, there would be the risk of irregularity in the flame.

Examination resumed: I have seen in practice the pressure so low, that the mere accident of the door of the room being open or shut when there is a fire in the fireplace, and you have got a chimney air-tight, will make an appreciable change in the light. When you ask me what is the least possible pressure, I should say that that is practically an improper pressure. That applies to an Argand as well as a bat's-wing burner. In both cases for efficient burning under ordinary circumstances, you ought to have some pressure so as to have some strength of flame. I am not speaking of a burner when used for testing the illuminating quality of gas, in the photometer, in a carefully guarded chamber, but of the burner used for ordinary domestic purposes. The least possible pressure would be that pressure, which would give you a practical and steady flame in the varying condition there may be in the room.

Turning your attention to the expression which is used in the beginning of Mr. Sugg's description, page 3, line 24, we are told that the improvements consist in the delivery of the gas into the chamber containing the aperture or apertures, at which ignition takes place, at a low velocity. Is "the delivery of the gas into the chamber at a low velocity," a correct expression?—Without reading on, there is nothing to show it is incorrect; but taken in connexion with the context, it must be a clear error in the description. The delivery into the chamber is at a high velocity, and the exit from the chamber is at a low velocity.

Now, Dr. Wallace told us that the pressure in the chamber may be taken to be pretty uniform from the point of combustion to the end where the inlet aperture enters. Is that right?—Yes. I think it would be almost impossible to appreciate any difference. Assuming the velocity at the orifice of combustion a somewhat lowered, the lowering of the velocity would take place in the isdy of the chamber. The inlet aperture would be the point of higher bolocity. I do not say it would gradually diminish; but it expands in the veamber. You feed the chamber by certain orifices which, in their united chea are much smaller than the outlet orifices. It seems to me, therefore, arat the point where there is the greatest velocity must be at the mouths of these smaller orifices.

Assuming that it would be correct, as stated here, that the means consist in the delivery of the gas into the chamber, not only at a low velocity, but also at a temperature exceeding that of the surrounding atmosphere as little as possible, to what in the Sugg burner would that lowering of temperature be attributed according to this description which follows?—To the passages of the gas through the three conducting channels; because I understand that the point where the temperature is to be as low as possible, is to be at the entry into the chamber. It was well known prior to the date of Sugg's patent of 1869, that the pressure at the point of combustion might be reduced by making the inlet area less than the area of combustion. It was also very well known that the best kind of top was the steatite top. I have read Williamson's specification, in which there is described a means of regulating the supply of gas to a burner, and a direction given that it is advisable to use an inlet area less, in the aggregate, than the area of combustion or emission area. I think the means described in that specification are quite sufficient to enable that to be done. If instead of a bat's-wing burner, a steatite Argand burner was employed with the Williamson apparatus, there would then be the means of reducing the velocity and lowering the temperature, that you have in the Silber burner.

Put an ordinary steatite Argand upon a Williamson's restrictor, and you have the same advantages that you find in the Silber burner?—Yes, that is in the Silber burner when it got the pair of cones to it. Without the regulator your comparison does not apply.

Examination continued: I do not think there is any substantial difference between the regulator used in the Williamson apparatus and the regulator used by Silber; and I can go further and say there is none that I can see between the regulator used by Silber and that used by Sugg. I believe that all those regulators are well-known things. I do not find in Williamson's specification anything which limits the application of his apparatus to a bat's-wing burner, and according to my judgment the drawing shows a fishtail burner; but for anything I know, that which is described is applicable to gas-burners generally; there is no suggestion that I recollect that it should be applied to an Argand. "No claim is made to the means of checking the direct flow between the inlet and outlet passages of gas-burners generally, where the inlet passages are of larger sectional area than the outlet passage." I think that that applies to all gas-burners. Durich patented an improvement in gas-burners, but I do not find anything which narrows the application of his improvements to any particular burner. It appears to me that the specification applies to all burners. There would be no difficulty in screwing on a burner to this apparatus. If the cone is part of the Silber burner, it is the same as Durich's. Put Durich's to a steatite chamber and you have the same as the Silber burner with the cone. Taking the regulator from Durich and Silber, there would remain the ordinary steatite chamber in both, the same as the Sugg burner as made, but not the same as specified. If it was metal, the low velocity and low temperature would be the effect of the channels. There is a mistake in saying gas enters the chamber at a low velocity, but assuming it passes through the point of combustion at a low velocity it would be due to the channels. There is nothing in the reference of Sugg's, unless the reference to the plans, which would lead any one to suppose that the specifications would not apply to all burners. If in connexion with the Sugg-Letheby burner there was a regulator and a steatite chamber, there would be no difference between the Sugg-Letheby and the Silber, as far as regards the lowering of the velocity at the point of ignition, nor as regards the lowering of the temperature if the temperature was lowered. I did not hear Mr. Stevenson's original evidence referring to the claim made by Mr. Sugg. The meaning of the word manufacture in my opinion would be that he claims the mode of making the burner, by casting together the three tops, which themselves are not to be of fusible metal, by means of fusible metal poured into metal moulds. I agree with Mr. Stevenson, that the regulating by a nose-piece is not an integral part of the plaintiff's invention. Comparing the Sugg burner with the Silber burner, I do not find anything in the latter corresponding to the three curved tubes of the former, unless Sugg's patent is for contracting orifices *simpliciter*, irrespective of the mode, and unless Silber's orifices are contracted; but I have no reason to suppose Sugg's patent is merely for contracting orifices, and I have no reason to suppose that Silber's inlet orifices are contracted. If the regulator is put in it gives the power of contraction to any extent. If the regulator was put in for that purpose, it would not be new, having regard to Williamson's and Durich's. The combination of the Silber burner is different to the combination of the Sugg burner. Supposing Sugg's is for regulating the three channels at the orifices of combustion rather than at the orifice of inlet, I do not find the combination of the Silber burner the same as the combination of the Sugg burner, and supposing the Sugg combination consisted of regulator channels, steatite chamber with orifices of combustion larger than inlet orifice, and with an air cone, I would not find in the Silber burner any combination like that. The bottom plate above the triangular openings in the Silber burner in my opinion, as far as regards the cooling, does not produce an effect like that ascribed to the three channels in the Sugg burner. The three channels in the Sugg burner are long and have large surfaces, and are away from the plate. This plate lies at the bottom of the burner, and whatever effect it does produce must be of the same character as that which is produced by the walls of a metal chamber of a Sugg-Letheby burner. The distribution in the Sugg burner is effected by the pipes which go at three different points and make the distribution. The distribution in the Silber burner is effected by the triangular apparatus in the gas-chamber. The ordinary crutch of the Argand was the distribution by two pipes previous to 1869. That was outside, the same as the Sugg. Distribution as adopted by Silber was not new. That was found in the prior specification of the patentee himself in 1868.

The witness was not cross-examined.

By Justice BLACKBURN: I cannot say if it was known in 1869, whether, on account of its effect either in keeping the flame hot or keeping the gas cool, it was desirous to use steatite. It is known now; but I think in 1869 it was desirable because it was incorrodible.

Mr. *Maximilian Felsenthal*, a member of a firm of brass burner manufacturers, produced three burners, all Argand with steatite or china tops, having different kinds of crutches and lava or porcelain chambers. He said he imported burners similar to these in 1865; recollected selling to Mr. Sugg in 1867 some similar to the one marked "M. F." before referred to.

Mr. *Frederick W. French*, foreman in the burner department of Messrs. Leoni and Co., produced two regulators and some Argand burners similar to those made in 1866, and said the chambers were made of metal, but the tops of adamas, which was a soft substance, like clay until vitrified by the action of fire. There was a quarter of an inch of adamas from the top down to the chamber, and a metal casing running up to the lip of the adamas top. The first time he ever saw a burner with a singular annular slit was about 1869, and was one for the purpose of burning gas made from petroleum spirit.

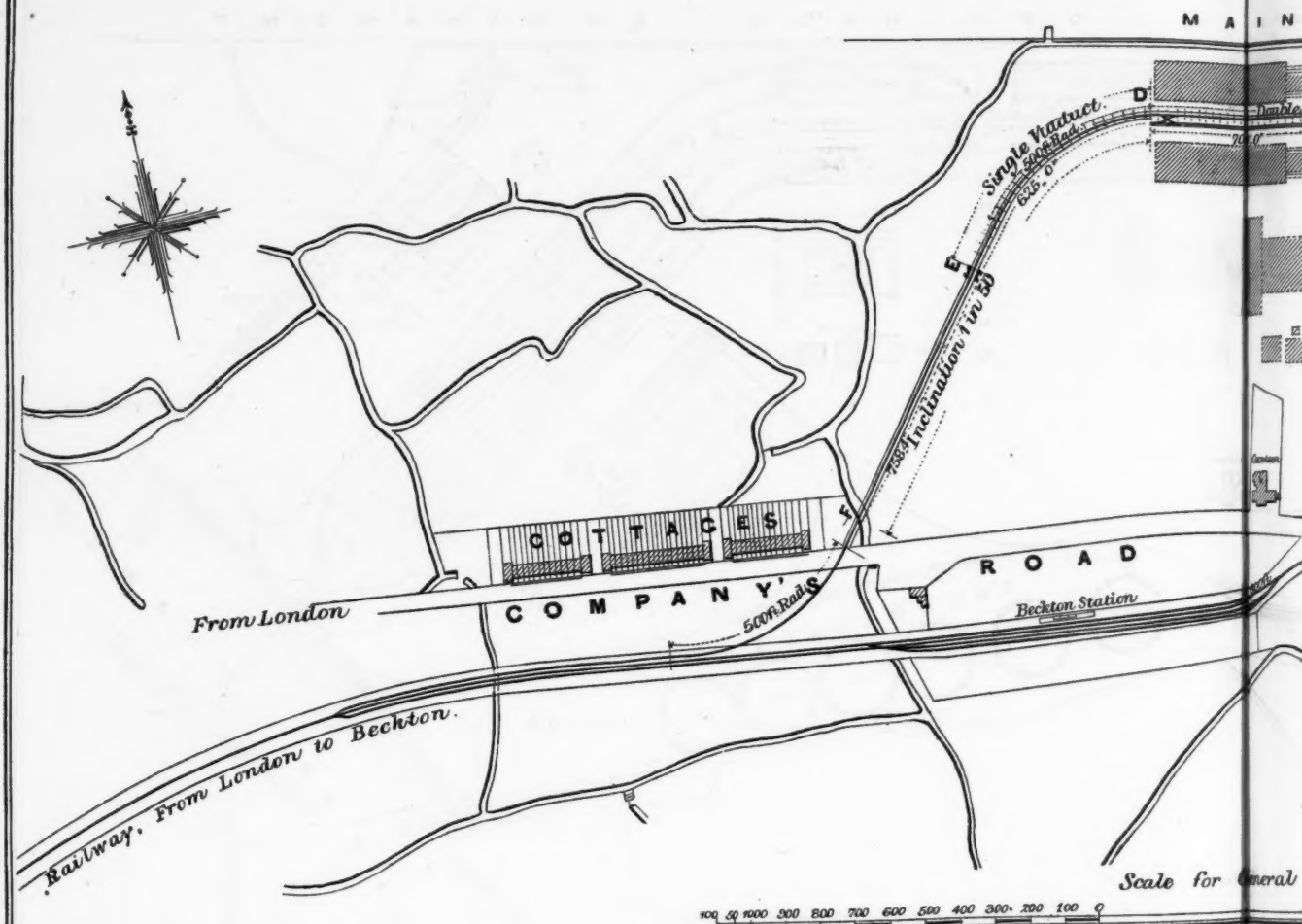
Mr. *David Duff*, a brassfounder and practical engineer, said he took out a patent in 1866 for "Improvements in Gas-burners," but did not go beyond the provisional specification, though he sold a considerable number of the burners in the course of his trade. He made the area of the inlet less than the area of combustion, but did not apply the principle to Argand burners.

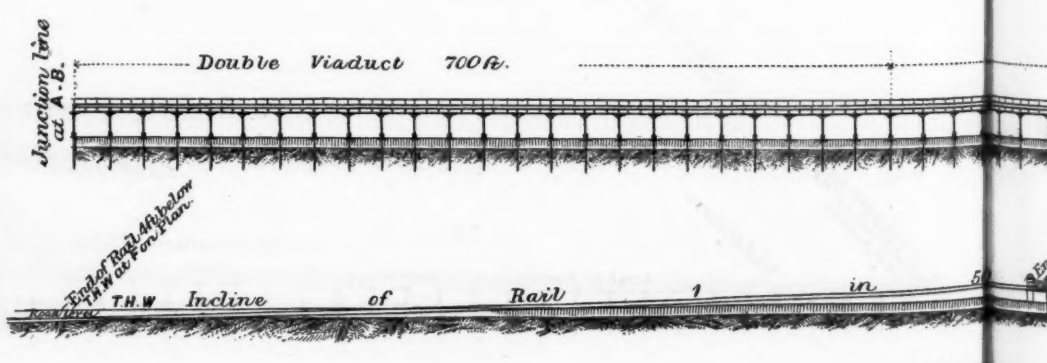
Mr. *Walter Moxley*, a gas-fitter in the employ of the Silber Light Company, said he recollected that before 1869 cones were used for regulating the flow of gas.

Mr. *Albert Marcus Silber*, examined by Mr. ASTON.

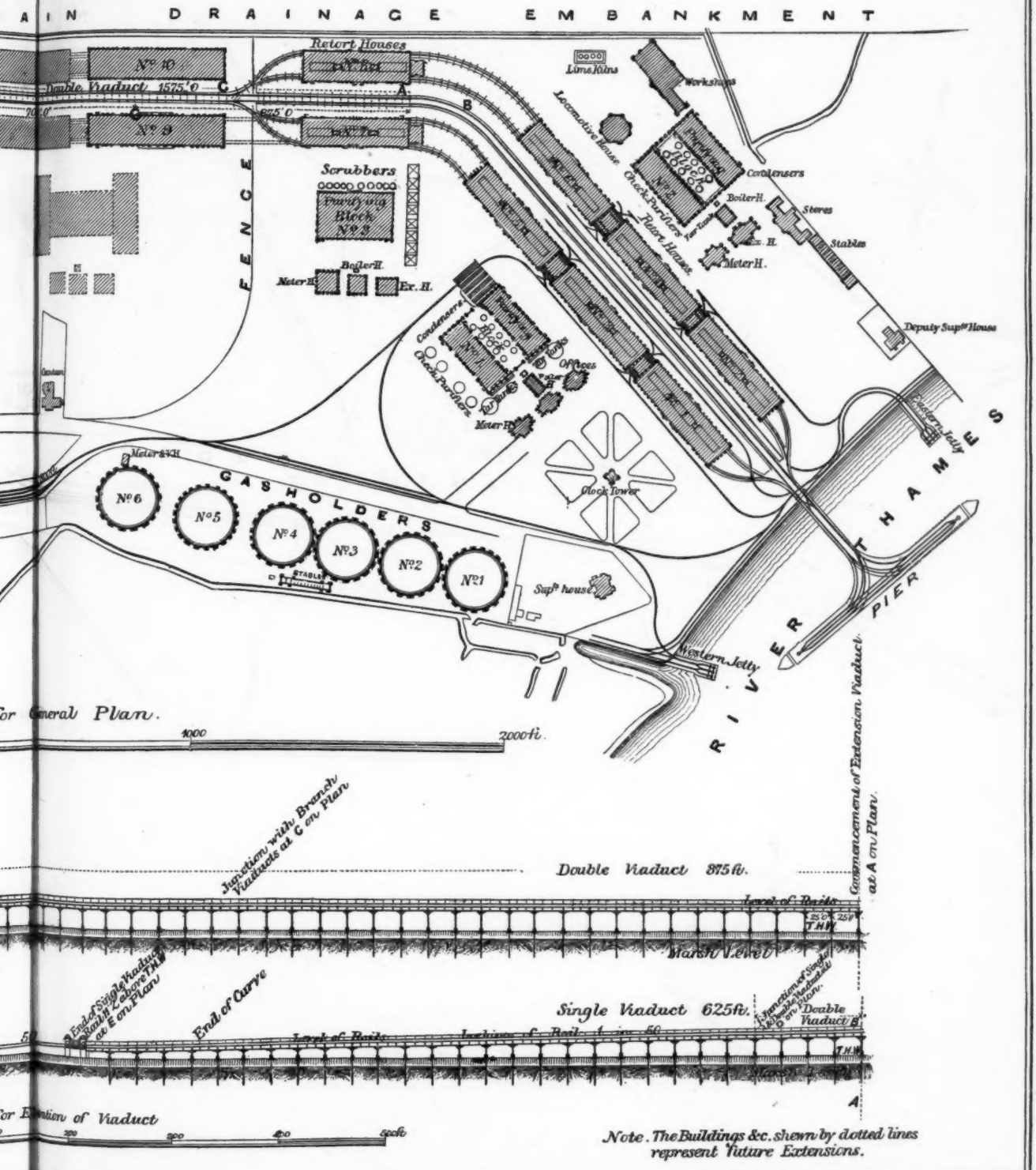
I am the defendant in this action. In the manufacture of my burners the gas flows from the inlet of the burner to the outlet, just the same as it would flow through an ordinary gas-pipe. It is not intended to have the chamber with the triangular orifices pressed down flat on the plate. In some of the specimens that have been produced it appears that it is pressed down. All the burners are constructed by hand, and the reason I give for one of the burners appearing as if the triangles were pressed down to the chamber, is that it might have been done by accident. The function of the triangular apertures is to divide the gas current. It is a good thing to divide the current of gas in a gas-chamber. I never saw the inside of a gas-burner until I made one. I have never supplied any burners to the Trinity House. All my gas-burners bear the letter "G," and they are numbered by consecutive numbers. The name of the "Silber Light Company" is stamped on some of the burners in addition to the letter, but in others it is not. It was owing to the custom we had of marking the burners that the letter "G" appeared on the burner. In my gas-burner I use a turn-over cone. An exact copy of the burner I gave to

BECKTON WORKS of THE GAS




Junction line at A.B.
Double Viaduct 700 ft.
End of Rail 4 ft. below T.H.W as For Plan.
T.H.W
Incline of Rail 1 in 5
Scale for Elevation

GAS LIGHT & COKE COMPANY



the Trinity House was made by a man of the name of Taylor in 1864. The cone has been used for oil lamps for ages.

Cross-examined by Mr. WILLIAMS: I am a merchant, and have been so for 23 years. I have occupied myself in the production of artificial light since 1869, and have been engaged in matters pertaining to gas since 1873. I copied my oil burner when making one for gas purposes. I never knew anything about the construction of a gas-burner until I made one by fitting a steatite chamber into an oil burner. I was not acquainted with the various improvements made in gas-burners previous to 1873. There is no pressure at the inlet of my burner, and there can be no pressure at the outlet. The pressure from the mains is reduced by the ordinary stop-cock. I turn the stop-cock on, and set the governor to a height of the flame I want it, and then leave it there. I understand the method of testing. Dr. Valentin has nothing to do with our company. In 1873 he was recommended to me by Dr. Frankland to assist me in testing operations, because I had not then the necessary apparatus. I never saw any of Mr. Sugg's burners tested previous to 1873, and I knew nothing more about them than any ordinary man. I have made two or three sizes of burners, but have not sold them, I have only sold one size. I never saw any of Mr. Sugg's "G" burners till to-day. I used to get my steatite chambers from Nuremberg. I do not know whether the place I get them from is the same place as Mr. Sugg obtains his from. I make no statement as to the merits of my burners. I simply send them out to the public, and it is for them to judge. They are made on a principle different from others in use.

Dr. *John Valentin*, examined by Mr. ASTON.

I have had great experience in gas matters, and am Demonstrator in Practical Chemistry at the Royal School of Mines. I have been professionally consulted by Mr. Silber, and have carefully examined his Argand burner with Mr. Sugg's. When I was gas examiner for the Western Company up to 1868, I was familiar with what had been done in the improvement of burners. I never saw Williamson's specification, and saw a Williamson burner last night for the first time. If an Argand burner were put to a Williamson regulator, there would be the means of lessening the inlet area and increasing the area at the point of combustion. I believe there is the same principle of reducing the pressure to a minimum in the Williamson burner as there is in the "London" burner. In 1862, the burner most commonly known as having an aperture was the bat's-wing or the fishtail. There would be no difficulty in screwing an Argand burner on the nose-piece where a flat-flame or bat's-wing burner had been employed.

Cross-examined by Mr. WILLIAMS: I remember Mr. Silber consulting me about gas in 1873. He submitted his burner, which was nearly finished before I saw it. I had used Sugg's burner before that time. It was a well-known burner, and had been selected by the referees as the standard burner for testing gas. I have compared Sugg's burner with Silber's in the photometer repeatedly, and the two burners produce almost the same results.

This concluded the case for the defendant.

Mr. *Heisch* was called for the plaintiff, and said he was familiar with burners previous to 1869, and he had seen hundreds of Argand burners with a single aperture for the emission of the gas at the burning orifice.

SATURDAY, MAY 20.

Mr. ASTON summed up the evidence for the defence. He said that in the course of the evidence he had been unable to put his finger upon any direct statement as to the combination of parts which his friend relied upon. The jury would have to consider whether, with the governor, the defendant's burner was an infringement of the plaintiff's patent, and whether without the governor it was an infringement. He should ask the jury, they having heard the evidence, whether they found in the Silber burner the following combination, which constituted the plaintiff's invention:—The gas-burner or regulator, curved arms or channels, steatite gas-chamber, and in the gas-chamber holes of combustion larger than the aggregate holes of inlet. Evidence had been given on behalf of the plaintiff that it was very important to have those three channels, because they were distributing, cooling, and restricting channels. These, to use the old simile, constituted "The Hamlet part" of the plate, because it had been stated over and over again by the witnesses that the regulator or governor was old, and that the steatite chamber was old, and that the orifices of inlet being smaller in area than the orifices of combustion were also old; therefore, every element of this combination was old. The air-hole also was old; and although the three channels were bent for the particular purpose of getting elongation, and although that bending was more expensive and probably not quite so graceful in appearance as the ordinary straight form, still they were there, as the witnesses for the plaintiff had stated, for the particular purpose of distributing, constricting, and cooling the gas. It had not been asked by his friend, of a single witness, whether the counterpart of the three arms *per se* were found in the Silber combination. Mr. Bramwell had stated that there was not in the Silber combination anything equivalent to the three arms. If it were true that the plaintiff claimed regulator, distributing channels that cool constrict and distribute, steatite chamber with top with large apertures compared with apertures of inlet area and air cones—if it were true that out of those five points in combination the air cone was at once dismissed, and if the three channels for restricting, cooling, and distributing were dismissed, as Mr. Bramwell said they ought to be dismissed, what was left? A combination of three, a combination of an old regulator, an old steatite chamber sold publicly in hundreds and thousands, as Mr. Felsenthal had stated in his evidence, and large orifices well known in the Sugg-Letheby burner. All that the plaintiff did prior to 1869, it was open for every one of Her Majesty's subjects to do outside the letters patent. Mr. Sugg had no more right to import into the particular combination that he relied upon, anything prior to 1869, than Williamson, or Durich, or anybody else. Mr. Sugg filed his provisional specification on the 18th of March, 1869, and when he came to file his complete specification on the 18th of September following, he found he could not claim the steatite chamber, and that which he referred to, in his provisional specification, as being something which he used of necessity, he stated in his complete specification he only used by preference; and he (the learned counsel) felt quite certain that under the circumstances his lordship would direct that the plaintiff had no right to prevent anybody using a steatite chamber; and that having regard to cases which had been decided before, the words as used in the specification would prevent Mr. Sugg from relying upon steatite as a new and material part of his invention. There was a well-known case reported in 8 Ellis and Blackburn, p. 1004, in which it was held that if a man claimed a combination he might claim every new and material part of that combination. In the case of *Clarke v. Adie* (Law Journal Reports, 10 Chancery Appeals, p. 667) that case had undergone a certain review. Lord Justice James, referring to the general dictum laid down in 8 Ellis and Blackburn, said that the combination when it was claimed could only give a protection to every new and material part of the combination, provided that in the claim, or in the specification, or somewhere else, it was indicated in a fair way by the patentee what his invention was, and if that new and material part was a new and material part of his invention. He could not afterwards go and tell the public that that was a new and material part which he had neglected to tell the public was a new and material part, because the public would not be on their guard. If Mr. Sugg were to argue that he had any right to a steatite chamber, or to prevent any one from taking a Sugg-Letheby burner and putting in the inlet chamber the steatite chamber, then he would be in error. If a Sugg-Letheby burner were taken with large orifices with steatite chamber and forked delivery, and if to that was applied a regulator or a governor, then there would be substantially the same parts in combination which were found in the Silber burner. In the Sugg-Letheby burner there was a regulator worked by cones which would restrict the area to any given extent. There were two channels instead of three, which were there for the express purpose of delivering the stream of gas in its divided form into the annular area of the gas-chamber. There were also the orifices of combustion larger than the area of inlet, and there was also—what all the world knew in 1868 they could adopt—the steatite chamber. He would challenge his friend to put his finger on anything that was in the Silber burner *plus* regulating area, distributing channels, steatite chamber, and orifices larger than the area of combustion. These were all open to any one to use, and it was impossible that the plaintiff could stop the use of them. Instead, however, of having a chamber like Sugg's, Mr. Silber said, "No; I will put into that chamber the same as Williamson and Durich put; I will put in it my distributor, because all gas must be broken up." Mr. Silber said he could obtain the result of a good illuminating power, but he would not borrow the plaintiff's means, he would put inside his gas-chamber the distributor, which Mr. Sugg had put outside. In the combination within the Silber burner there was a single part, the regulator, a combined chamber and distributor, orifices of combustion larger than orifices of inlet, and the steatite chamber; and it would be for the jury to say whether those were, taken together, a combination such as the plaintiff claimed. The defendant had been in the habit of marking his burners with letters; and because he called gas-burners "G," paraffin-burners "P," and moderator-burners "M," the plaintiff tried to set up the miserable story about the "G." He merely alluded to this, and would dismiss it. What he principally contended was, that the combination of five parts was not found in the Silber burner which was found in the plaintiff's burner. It was true that there was as good a result. It was admitted that under many circumstances the Silber burner was a better burner; but he was not there to advocate the superiority of the one or depreciate the other; all he had to prove was that the two burners were in the elements that were combined together, distinct. If the steatite chamber was common property at the time of the invention, the jury must dismiss it from their minds; they must go step by step and part by part, and say, "Is there anything equal to these bent tubes?" because that was the only question to be decided. The patentee said in his specification, "The improvement in manufacturing relates to the casting," and it was very singular that Mr. Williams, in his opening, threw in the casting as something which went to make up the invention. His friend had said that the objects to be attained by the patent were, first, the regulating the quantity of the gas and also of the velocity of the gas so as to reduce the velocity as much as possible; then the next point was to make the chamber of steatite or any other non-conductor of heat, to avoid the heating or combustion of gas; and thirdly to secure the accuracy of these things by casting. If the casting constituted a combination, clearly the defendant had not infringed that; and if his Lordship asked of the jury whether they had found anything in the defendants combination equivalent to the bent tubes, he awaited with great confidence their answer to that question. If it were true that the Sugg burner was a bad burner when it was made with the area so small as to reduce the pressure at the point of ignition to an inappreciable quantity, then it was a bad burner: but the plaintiff did not say what were to be the limits of variation, and this he was bound in law to do, because otherwise the public would have to make experiments in order to test it. If there were not definite instructions the patent was insufficient in point of fact, and also in point of law. The learned counsel then proceeded to quote authorities to show that any specification that required a number of experiments to ascertain its meaning was in itself bad. If "means employed in making" referred to the parts that were put together, he would ask the jury for a verdict, because, irrespective of the combination, he was positive that they would be of opinion that, having orifices larger than inlet area in the Sugg-Letheby burner—if inlet area was the area of the regulator—that relative size was old, and he was sure they would also be of opinion that the steatite chamber was old and that the regulator was old. If then, it was true that "means employed" meant casting them, as his lordship had already said, that was old; and if "means employed" meant any one of these parts, then he should with great confidence ask them for their verdict on the question of novelty. The production of Williamson's specification alone was sufficient, and that document must be read not as it was in 1859, but as it would be in 1868, because it was public property in 1868, and if the jury applied the same construction to Williamson and Durich and Johnson and Duff as they applied to Silber, they must give a verdict for the defendant. If it were true, as stated by Mr. Bramwell, that by simply adding to Williamson's that which was known in 1868, there would be a Silber combination, then he would ask a verdict also upon the point as to whether or not they could find Mr. Silber guilty of infringement; but if they were in doubt about the verdict of infringement, he should also ask them as a necessary consequence to give him a verdict upon that point of novelty. Before he sat down he should ask his lordship what was to be done with the second count.

Justice BLACKBURN: I think there is no evidence, and you are entitled to a verdict upon it. There is nothing whatever to go to the jury upon that. If there is anything as regards costs, have a summons before me at chambers.

Mr. WILLIAMS then replied upon the whole case. Three questions, he said, would be submitted to the jury—one was whether Mr. Sugg's invention was new at the time he took out his patent; the second was whether he had specified that invention with sufficient clearness and exactness, so as to meet the requirements of the law; and, thirdly, whether Mr. Silber had infringed that patent. Whether the invention was new or not was to be ascertained first of all by asking the question, what was it that Mr. Sugg had invented and patented by his specification. In order to arrive at that, the specification must be read in the light of the public knowledge of the subject-matter, at the time that specification was filed by the patentee. Mr. Sugg had said that in 1858 his attention having been directed to this subject, brought out an improved burner called the Sugg's 12-candle burner, in which he introduced, for the first time, the practice of having large instead of small holes. The Sugg-Letheby burner was a slight advance upon the old burner of 1858, and that burner was adopted, as Mr. Sugg had said, by all the scientific people connected with gas, and was used as a standard burner in England, America, the Colonies, and all over the world. Mr. Sugg and Dr. Letheby having made a step in advance in improving these burners, did not jump, instantly and monopolize that improvement by a patent, but, as men devoted to their business, and endeavouring to make improvements, they were content to allow that to be robbed by the public, and took out no patent. From the time the Sugg-Letheby burner was introduced, from 1862 or 1863 to 1869, Mr. Sugg was experimenting with Dr. Letheby on a larger scale than anybody in the gas world, and it was an admitted fact that the improvement made by Mr. Sugg in 1869 was a valuable one. That being so, he might dismiss a cloud of evidence that had been introduced by his friend to disparage the utility of Mr. Sugg's invention. Mr. Sugg had stated that he, contrary to the opinion of all scientific people, discovered that it was an important thing to bring about the results of reducing the velocity of the gas, keeping down the temperature, preventing it from heating in the chamber, and keeping the pressure at a point of ignition at an inappreciable point, and having made these discoveries, and having found himself almost alone in them, he set about finding the means of giving practical effect to his discovery. He had admitted, in the frankest way, that every one of these means in detail was as old as possible. The use of the large holes was Mr. Sugg's own discovery, and was applied to the Sugg-Letheby burner, and which everybody was at perfect liberty to use, and the other means were not new; but what Mr. Sugg said was, "I am the discoverer of the secret, that it was an important and useful thing to bring about these two or three results, and I show you the practical way of doing it." He (the learned counsel) ventured to say that the

specification did indicate that, and that it was drawn out in the clearest possible way. Mr. Aston had produced a lot of specifications, but not one of them pretended to say that the same result was produced as by Mr. Sugg's combination. Mr. Aston had claimed a verdict upon the question of infringement or upon the question of anticipation by putting the plaintiff in this dilemma. He said Williamson's specification was an anticipation; if not, Sugg's was not an infringement; but he never asked a single witness whether Williamson's specification, with or without anything attached to it, did or did not produce those results. It had been stated by all scientific persons, and those acquainted with gas, that up to 1869, the date of Mr. Sugg's invention, they all stoutly refused to believe in Mr. Sugg's statement, and when the patent was brought out they all said that it took the gas world entirely by surprise. As to the question of the sufficiency of the specification, he understood that the question of fact with regard to it would be involved in the application of the law to it. Was the specification, read by a person of intelligence and a person of skill in the particular subject-matter to which it related, sufficient to inform him what the invention was, and to enable him to make it? When the patentee got his monopoly for 14 years, he was obliged by the law to make a clean breast of his secret, so that the public would have a clear and undoubted description of what the patent was, and how to make it. Witnesses had been called who stated that there was no doubt as to the sufficiency of the specification. As to the question of infringement, he admitted that, when he opened the case, he made some rather hard observations upon Mr. Silber, but he would leave the jury to judge whether these remarks were well founded or not. They would observe that there was no question at all about the value of the invention, and he was sorry, for one reason, there was not; but they had had materials before them, which would enable them to judge of the enormous value of the invention to the public. Mr. Sugg had stated in his evidence the extent to which it had improved the illuminating power of gas. They all knew what an enormous consumption of gas there was in London, that it cost very nearly £4,500,000 per annum, and if a calculation were made as to the improvement in the gas consumption, effected by Sugg's burner, it would be found that the saving effected was no less than £500,000 per annum. Mr. Silber, who was a merchant dealing in all sorts of articles, had said that, in 1873, he having no knowledge of gas, scientific or practical, more than any ordinary man, after Mr. Sugg's patent had been taken out, and after it had been adopted by the gas referees, after it had been selected as the best, and had come into common and universal use, invented his Silber burner. Mr. Silber had stated that such was his ignorance upon this subject, that he knew nothing about the Sugg-Letheby burner, or about the early steps of progress; such was his ignorance, that he went to Mr. Valentin, who was a skilful man, and well acquainted with gas matters, to get assistance from him, and knowledge to enable him to bring out the burner. He went to Mr. Valentin, and actually produced to him a finished and complete burner, equal, if not superior, to the burner produced by Mr. Sugg, which took the gas world by surprise, and was the result of years and years of the most patient experiments on the part of Mr. Sugg and Dr. Letheby. The Silber burner was suddenly evolved—like Minerva, fully armed from the brain of Jupiter—from the brain of Mr. Silber. If that was true, it was one of the most astounding inventions he had ever heard of. It was an astounding thing that a man, utterly and absolutely ignorant upon the subject, should produce one of the most valuable things, which was a perfect counterpart in some things of Mr. Sugg's burner. The question might be asked, where was the infringement? He would answer, in the first place, that the same, and even a better result was produced by the Silber burner than was produced by Sugg's. It was not suggested that any other burner produced this result. Mr. Silber produced this result by the same means. In the first place, there were the large holes; in the second place, the cooling material of which the chamber was composed; in the third place, there was the apparatus at the neck which regulated the inlet of the gas; and fourthly, there were the small holes which constricted and assisted the regulation, and prevented the gas from passing rapidly into the burner. The reason he did not cross-examine Mr. Bramwell was because he had, from the evidence of Mr. Imray and Dr. Wallace, evidence enough to show that it was an infringement. Dr. Wallace, on opening the burners, found that the steatite chamber of Silber was capable of sending through a large quantity of gas, showing, in fact, as the result of his experiments, that if there was any value in the test put by these scientific people, there was a higher pressure at the point of emission than at the point of inlet. It was possible for those persons who were clever enough to copy other people's ideas, and pirate their inventions, to make the copy appear such that one could not tell the particular part where the infringement had been made. Taking the thing as a whole, he would ask, assuming Mr. Sugg had made a discovery, and carried out the means of bringing it into operation, had Mr. Silber produced the same results, and carried them out by those means. There were other points upon which he might have touched, but with which he would not trouble the jury, and he would leave Mr. Sugg's case with confidence in their hands.

Justice BLACKBURN then summed up the case to the jury. He said there appeared to be two issues raised—one as to whether the plaintiff was an inventor, and, if the invention was new, whether or not a patent should have been granted for it. Upon that there would be a question of fact, and it would be necessary to go back to the time the patent was taken out in 1869, and ascertain the then state of the public mind, in order to see whether the invention was new. If the plaintiff did really, before 1869, invent the "London" burner, and that burner did produce a new and beneficial effect, then it was the subject for a patent. Therefore, the first question would be whether they thought the "London" burner, as actually used and made by Mr. Sugg, showed a practical means, by the combination described in the specification, of producing a new and beneficial result. If so, although every one of those means had been used before, yet, if the combination of all of them brought together showed a practical means of producing a new result, it would be the subject of invention for a patent, and would be a new patent. The second question was as to the specification. For the last 150 years it had always been the practice in patents to put in a clause, saying that, within six months, the patentee should make a specification, the object of which was to describe the invention, and to state how much was new, so that people might be warned from trespassing; and if a man had claimed too much in his patent, he would be enabled, by disclaimer, to get rid of it. There was a contention that anybody who cast all the pieces described in the specification in one piece had infringed Mr. Sugg's patent, but that point had been reserved for the court above. There was another thing required in the specification, and that was, that the patentee should state fairly and truly the best means he knew of for carrying it out. It was not enough that it should describe the heads of the invention such as any clever man might catch; and, on the other hand, a man was not obliged to state his invention so minutely as that an ignorant man taken from the street would be able to understand it. What the plaintiff really had to do in his specification was, to give such a description that a man of competent skill, and sufficiently acquainted with the manufacture of burners, could make the burner in 1869. From what he (the learned judge) could understand, the two great points of the "London" burner were, that the gas was let in by a constricting chamber through an orifice, of which the inlet area was a great deal smaller than the area of the exit orifice, and the consequence, of course, would be that it would come out slower from the orifices where it was burned than from the chamber; and it was also obvious that the degree of speed at which it issued from the holes of emission would depend upon the pressure at which it went in. If, for instance, at night, when the pressure on the gas-pipes was seven times as great as during the day, the stop-cock were to be left on, the gas would come out with much more force from the mouth of the "London" burner than it would do in the daytime when the pressure was low, and it was also obvious that the flow of gas must be adjusted more or less by turning the cock fuller or less full, according to the pressure at the mains. The benefit derived from the heat not travelling down the steatite chamber from the point of combustion, seemed to him very considerable, and it was a fair question whether a man reading the earlier part of the specification would say that it told him pointedly how to keep the chamber cool. Would a man, notwithstanding the words "by preference," knowing that the steatite chamber or a porcelain chamber was used before, be aware that was the means which Mr. Sugg proposed for keeping the gas cool? If the description was sufficient for that purpose, then, subject to the point which had been reserved, he thought that the specification would sufficiently describe and indicate what was done. If a man of competent skill and knowledge in 1869 honestly set his mind to carry out Mr. Sugg's specification, and could make a burner as Mr. Sugg actually made it, that would be a sufficiently good specification, and no fault would be found with it. They would also have to decide whether the words "least possible pressure," were a sufficient indication of the "London" Argand, and if the specification was good upon these grounds, had the defendant infringed it. Steatite chambers were no doubt used both by Mr. Sugg and others previous to his invention of 1869, but what Mr. Sugg said was that letting the gas out at an inappreciable pressure at the top of the non-conducting steatite chamber prevented the heat getting down to the gas. It was immaterial what was the real principle, but Mr. Sugg said the effect of that was to produce a new beneficial result that had never been produced before; and other witnesses had said that it took the gas world by surprise. Now, it was quite immaterial whether Mr. Silber intentionally took this from Mr. Sugg's "London" burner or not; but if it produced the same results from a certain combination, then, if he did not use the whole of the combination, even if the same results were produced by leaving out some parts—he might be leaving out something superfluous, and so far it might be an improvement—yet it would be an infringement, provided always the same result was brought about, by what was in substance part of that which formed the combination. His lordship then went into a critical comparison of the two burners, and dealt with the evidence that had been given bearing upon their construction, and then left the following questions to the jury:—First, whether or not this was an invention that practically produced new and beneficial results, if so, was it a subject for a patent; secondly, did the specification indicate or disclose to a man of skill the mode in which Mr. Sugg produced the benefit, which certainly was produced by the "London" burner, with a chamber attached; also did the words, "least possible pressure," sufficiently indicate the relative proportions of the area involved in the question; if that was so, the specification was good; and, lastly, did they consider that what Mr. Silber had done was an infringement.

The JURY, having consulted for two or three minutes, returned a verdict for the plaintiff on all the issues.

MONDAY, MAY 29.

(*Sittings in Banco, before Justices* BLACKBURN, MELLOR, *and* FIELD.)

Mr. ASTON moved, in the above case, for a rule for a new trial, on the ground of misdirection.

Justice BLACKBURN said the court would grant a rule as to the sufficiency of the specification, and the propriety of the questions left to the jury in reference to that and to the drawings. The court would not grant any rule as to his direction upon the question of what would be a sufficient invention, or a new manufacture for which a patent would be granted, nor would they grant a rule as to the sufficiency of the direction upon the question of infringement, nor upon the ground that the verdict was against the weight of evidence.

Mr. ASTON asked for a rule upon the question of whether the invention was the subject matter of a patent.

Justice BLACKBURN said his learned brethren were of opinion that his direction as to what would make it the subject matter of a patent was perfectly right.

Rule *nisi* granted.

WEDNESDAY, MAY 31.

(*Court of Appeal, before the* LORD CHIEF JUSTICE, *the* MASTER OF THE ROLLS, *Lord Justice* MELLISH, *and Baron* POLLOCK.)

Mr. ASTON appealed against the above decision of the Queen's Bench Division sitting *in Banco*, and after hearing him for some time,

The COURT said they thought that he had made out a case for a rule *nisi* on the point whether there was evidence of any infringement by the defendant of the plaintiff's alleged invention. As, however, there was already a rule granted by the Queen's Bench judges, not only upon points reserved, but also on one or more grounds of misdirection, and as, if they decided in favour of the defendant, it might be necessary to come to this court again, it would be better that the case should be argued and decided in the Queen's Bench Division on the other points; and then, if they decided against the defendant, he could come here on the present application, and the plaintiff would show cause against it before this court. There would be a rule *nisi*, and it would stand over until the points raised in the Queen's Bench were determined.

NEW WATER-WORKS AT WARRENPOINT (IRELAND).—The Warrenpoint Water-Works were formally opened on the 22nd ult., when Mr. Barton, C.E., presented a drinking fountain to the inhabitants. The reservoir, which covers seven acres in extent, is capable of containing three months supply for a population of about 5000. It is situated about a mile outside the town, on the north side, and is fully 120 feet above the level of the town, so that the pressure is sufficient to drive the water over the highest house in the town. The works will cost £5000. Mr. Bower, C.E., was the engineer. Messrs. Mahon and M'Murray, Newry, had the contract for making the reservoir.—*The Builder.*

NEWARK WATER-WORKS COMPANY.—The annual meeting of shareholders was held on the 29th ult.—Mr. J. Knight presiding. The report showed that the revenue of the company for the past year had been £2477 8s. 11d., as against £2313 9s. 1d. in the previous year. The balance available for dividend was £1071 12s. 8d. The reserve-fund now amounts to £78 14s. 1d. The directors recommended the payment of a dividend of £7 per cent., free of income-tax, on the paid-up capital of the company, and that the balance of the revenue account (£91 12s. 8d.) be carried to the reserve-fund. The works are in a good state of repair, and in satisfactory working order. The secretary (Mr. Newton) called attention to the waste of water in the town. He stated that during the first three months of this year he had taken a record of the consumption, and compared it with a similar period in 1870. The result was that, taking 90 working days, the average pumping per day in 1870 was 11 hours, and in 1876 it was 19 hours. The gallons pumped in the same time in 1870 were 20,531,552, being an average of 228,128 gallons per day, or 17 gallons per head of the population of the town. In 1876, about 39,668,610 gallons would be pumped, giving an average of 440,964 gallons per day, or 34 gallons per head. There would be a practical difference of one day in the latter period, in consequence of its being leap year. In most towns where works had been established a length of time, as in this town, the average consumption should not exceed 30 gallons per head; and as the return he had given only applied to the first three months of the year, taking the year through, the average would be greater. Under these circumstances, it would be necessary that the matter should be looked to, and the waste checked. The report was adopted.

Miscellaneous News.

IMPERIAL CONTINENTAL GAS ASSOCIATION.

The Half-Yearly Ordinary General Meeting of Proprietors of this Association was held at the City Terminus Hotel, Cannon Street, London, on Tuesday, the 30th of May—PHILIP TWELLS, Esq., M.P., in the chair.

The SECRETARY (Mr. Albert F. Jackson) read the notice convening the meeting; the seal was affixed to the register, and the following report presented:—

The present half-yearly ordinary meeting of the shareholders has been convened agreeably to the company's Act of Parliament for the purpose of receiving a report from the president and directors upon the affairs of the association, and for declaring a dividend for the half year ended the 31st of December last.

Gas Made.—The total quantity of gas made at all the stations in the half year ended the 31st of December last, 1875, was 2718 million cubic feet. The total quantity made in the corresponding half year of 1874 was 2728 millions, being a decrease of 10 millions, or at the rate of ·37 per cent. The loss of 130 millions at Brussels more than accounts for this diminution.

Lights.—The total number of lights at all the stations on the 31st of December, 1875, was 1,095,371. The total number of lights on the 31st of December, 1874, was 1,087,549. These figures show an increase of 7822, which is at the rate of ·72 per cent., notwithstanding a decrease at Brussels.

Mains.—The total length of mains laid up to the 31st of December last, 1875, was 1131 miles, being a decrease of 54 miles on the corresponding half of 1874. There was a loss at Brussels of 76 miles.

At the various stations of the association the works and apparatus during the half year now under consideration were all in thorough repair and good working order, and proved sufficient for all requirements.

Mr. G. W. Drory has been ably assisted by the several local engineers and agents in his general superintendence of the conduct of the business, and of the affairs of the association on the Continent.

The rental for the half year ended the 31st of December, 1875, was less than for the corresponding half year of 1874. The decrease was owing to the association having ceased to light Brussels on the 31st of August last. The profit, however, was greater.

The cost of the coal employed during the half year now under review was 3s. 6d. per ton less than during the half year ended Dec. 31, 1874.

Secondary Products.—The value of the secondary products—coke, tar, and ammonia—was 68 per cent. of the cost of the coal, being an increase of 4 per cent. on the corresponding half of 1874.

At Vienna the new tank and gasholder for the Währing station were completed in the month of October last.

Plots of land were also purchased at the Tabor and Fünfhaus stations to meet the future requirements of the association.

At Stolberg the new gasholder was put into action in the month of November last. Extensions of mains of various sizes have been made at all the stations at considerable cost, the principal outlay under this head being at Vienna, at Ixelles and Molenbeek, St. Jean, in the vicinity of Brussels, and at Frankfort-on-the-Maine.

At Bordeaux the valuation *expertise* of the entire works, mains, and other property of the association, to which allusion was made in the last report, was concluded, and the award was on the 4th of last September deposited at the mayor's office. Exception to that award having on the 22nd of October last been taken by the expert appointed by the "Société Financière," litigation ensued, and finally, on the 29th of December last, judgment sustaining the award was given in favour of the association on all points, with costs.

At Brussels, towards the end of last July, the experts handed in their award, settling the amount to be paid by the Municipality to this association for its town works. Subsequently the town, upon the 1st day of last September, the day, namely, on which it commenced the lighting, paid over the portion of the above-mentioned amount which had been agreed upon.

With regard to the balance still due to the association under the expert's award, litigation was commenced by the town authorities last October. Towards the end of last November they lost their cause in the Court of First Instance, and were condemned in costs.

The president and directors have much pleasure in announcing that bonds to the amount of £33,000 were paid off last December.

They desire now, in conclusion, to draw the attention of the shareholders to the accounts for the half year ended the 31st of December last. These have been duly audited, and from them the directors have, in accordance with the provisions of the Companies Clauses Consolidation Act, prepared a scheme showing the profits of the association for the last half year, and the portion thereof applicable to the purposes of dividend, which the president and directors recommend now to be declared—namely, a dividend of £2, and a bonus of 15s. per share, payable, free of income-tax, on and after the 15th of June next.

The directors who go out of office by rotation are James Helme, Esq., Henry Wood, Esq., and John Horsley Palmer, Esq. The auditor who goes out of office is Thomas Newton Stokes, Esq. These gentlemen are all eligible for re-election, and offer themselves accordingly.

The CHAIRMAN: Gentlemen, some of you may very possibly have forgotten what I remember I stated at our last meeting—viz., that our association was very much dependent upon the price of coal for its success or failure. On the last occasion our success had been greater than in the then preceding half year, at the same time it was not altogether so encouraging as we had hoped. But since that time the price of coal has been quite in our favour, and the results are such as you have heard in the report just read. Now, I do not think there are many observations I can usefully add to the information in the report itself; but there are one or two points in reference to which the board are desirious to lay before you the reason for the course they have pursued in recommending the large bonus, which the meeting is invited to declare. You will remember that for the three half years preceding the last, we were obliged to reduce the rate of our dividends. The profits of the last half year have been much more satisfactory, and we are able now to offer our old dividend of £2 per share, and even then we find we have a surplus. Now, it was a matter of grave consideration with the board how that surplus should be disposed of. In the first place, we have always a great desire to preserve the rate of our dividend as even as possible—always to divide the same sum as near as we can, and when we once make an increse in the dividend, we desire to see our way to maintain it at the increased rate. We were very anxious to adopt some course like that on this occasion. On the other hand, it seems rather fairer that when money has been earned in one particular half year, the parties who receive the dividend out of that fund should be the parties who hold the shares at the time the money is earned. On the present occasion, the number of shareholders has very little increased. During the last half year there have been only 58 added, and we have, therefore, the pleasure of believing that the shareholders who will receive an increased dividend in the shape of a bonus will be to a great extent, and as nearly as possible, the same parties who suffered the reduction when our dividends fell to 35s. per share. We, therefore, thought—subject, of course, to your direction—that this would be a fairer way of dividing the money than any other. Whether we shall be able in any future half year to repeat the bonus, will depend entirely upon the amount of our success; I cannot hold out any promise in that direction. We, on this side of the table, will be happy to do so if the accounts permit; at the same time we ask you, as a prudential measure, to accept the 15s. bonus on this occasion, without any promise of what may be done next half year. I think I may say from this chair, that we have always been most careful not to hold out any promises which we did not firmly believe we should be able to fulfil. Notwithstanding, we give you this dividend and bonus, we make provision for the very large extensions we quite believe will follow the completion of the new contract at Vienna. The consequences of that contract, which will probably be a reduction in our profits at Vienna for a time, will not be fully realized in the current half year. You are aware that when enlargements and extensions have to be made, there are usually but three sources whence the necessary funds can be obtained. We may make the cost of them a part of our capital; or we may apply a portion of our income to this object, or we can borrow money on debentures. Of course, we should be sorry to make any further call for such a purpose, and we cannot consistently borrow money on debentures for it; it is, therefore, entirely from our income that we must take the money to make these extensions. But we are not altogether in that position at the present time, because we have received a sum of money from Bordeaux, and also one from Brussels. Now, the most legitimate application we can make of the funds thus taken away from two of our investments is to apply them in extending our works, either at new stations or at those stations we have already acquired. If, therefore, the money we have laid aside out of our earnings is not sufficient for our new requirements at Vienna, we have these funds upon which we can fall back. Thus, though these funds are not divisible in the shape of dividends, they leave us at liberty to appropriate a larger portion of our earnings for the purpose of dividend than we should otherwise be able to do. There is one other point, to which I alluded at the last meeting. We were very anxious to reduce our bonds, and also to write up the £6 5s. still remaining upon our shares. With regard to the bonds, you have already heard that £30,000 worth have been paid off. Another £27,000 will fall due in June, after which £4000 only will remain unpaid. With reference to the writing up of the £6 5s. per share, most of you are aware that there has been some difficulty about it, because our Act of Parliament requires us to keep uncalled a sum equal to the money raised by us on debentures. Of course, that liability has been reduced by what is paid off, and will be further reduced when the £27,000 due next month has been met; and, with regard to the remaining £4000, it is so small, that it need not interfere with any arrangements we may think it right to make. At the same time, you may conclude, by the subject not being mentioned in the report, that I am not in a position to announce any distinct arrangement on the point; but I believe I may say this much, that now the bonds are almost all cleared off, what we propose to do is, to take the opinion of some counsel learned in the law, stating our position with regard to the debentures, and asking for an opinion as to the best mode of writing up the £6 5s. If the advice we receive is, that there is no difficulty in doing it either with the concurrence of a general meeting, or on the action of the board itself, we shall be disposed to adopt that course. Upon this you may rely, that it will either be done before the next half-yearly meeting, or that at that meeting you will hear such causes and reasons for its not being done as will, I hope, be satisfactory to you. The report just read to you is altogether so satisfactory that I very much regret our excellent friend, Sir Moses Montefiore, is not here to congratulate you upon the state of the affairs of the association. I have received from him a note, as I usually do when he is not present at our meetings, expressing the regret he feels at being prevented by a severe cold from leaving home, and desiring that his hearty congratulations may be conveyed to the shareholders on the success which has attended our operations in the past six months. He expresses his conviction that the report presented will be highly satisfactory to the meeting, and make manifest to the shareholders the unwearied diligence and attention paid to their affairs by the directors and their efficient staff of *employés*. When a gentleman attains the age of 94, a severe cold furnishes a sufficient excuse for his not coming from Ramsgate to London to attend a meeting like this. I do not know that I have any further information to lay before you, and, therefore, simply intimating that I shall be happy to reply to any inquiries addressed to me, I now move—"That the report be received, adopted, and entered on the minutes."

Mr. JOHN RICHARDSON seconded the motion.

The adoption of the report was at once put and carried.

The CHAIRMAN moved—"That a dividend of £2 per share, and a bonus of 15s. per share on the 56,000 shares of the association, be declared for the half year ending the 31st of December last; and that the same be payable, free of income-tax, on and after the 15th of June next, as recommended in the report."

The motion was put and carried.

The retiring directors and auditors were severally re-elected, and, on the motion of the directors, a very cordial vote of thanks was given to Mr. G. W. Drory, and the staff of engineers at the various stations, for their continued attention to the interests of the association.

Mr. PRICE moved a vote of thanks to the chairman and directors of the association, and expressed the great satisfaction he felt with the report which they had laid before the proprietors on the present occasion.

The motion was seconded by an honourable proprietor, who suggested that the approbation of the proprietors should be manifested in a more substantial form than in a vote of thanks—an opinion which was so fully shared in by the meeting, that, on the present motion being carried,

Mr. PRICE gave notice that at the next meeting he would move an addition of £2000 to the remuneration of the directors.

The CHAIRMAN, in responding to the vote of thanks, said: Allow me, on behalf of my brother directors, and in my own name, to tender you my best acknowledgments for the kind manner in which you have recognized our exertions. As to the question of the remuneration of the board, that is a matter which, by our Act of Parliament, is left entirely in the hands of the shareholders, and if they are not satisfied with the amount we at present receive, it is in their power to give us a suitable increase. As I am the oldest director present, and, therefore, probably the less likely to derive any prolonged advantage from an increase in the remuneration of the board, I may perhaps say—and I think it only fair and just to my colleagues to express the opinion—that the remuneration given to the directors, considering their services, and the dividends paid to the proprietors, is rather disproportionately small; and if the shareholders should see fit to increase the amount, it certainly will not be undeserved. As a matter of principle, it is quite within the power of any meeting to fix the remuneration of the board; but it would be more satisfactory to the directors that it should be done after notice given.

The proceedings then terminated.

CADIZ WATER-WORKS COMPANY, LIMITED.—The ordinary general meeting of this company was held on the 12th ult. at the Cannon Street Hotel, London—Mr. W. Hawes in the chair. The report of the directors stated that the board had neither lost their confidence in the soundness of the undertaking, nor in its ultimate success, if the shareholders, having equal confidence, joined them in making one more effort to secure it. By the balance-sheet it would be seen that on the debtor side of the account there was outstanding on the 31st of December last—On temporary loan account, £17,750; on bills payable, for stores, &c., £3321 19s.; to sundry creditors, 9954 11s. 11d.; total, £31,026 10s. 11d. That sum had at the present time been reduced to about £26,000. Besides this £26,000, there may have to be provided £5000 to carry out, in the course of the next 18 months, the additions to the works contemplated under the proposed new arrangement with the Municipality. The shareholders had, therefore, now to determine how the deficiency of £26,000 already referred to should be provided, and they had to consider their position, if by their failure to find this amount, the debenture-holders should, in self-defence, foreclose their mortgages; and they would not, of course, forget that for want of this sum they were throwing away their interest in an enterprise—now in full working order—on which they have expended a large capital, and which must every year increase in value. The directors anticipated that the increasing demand for water during the summer, together with strict economy in every department, and the new agreement with the Ayuntamiento which was expected to be shortly completed, would, ere long, produce an equalization between receipts and expenditure, to be speedily followed by a gradually increasing surplus. The report, after some discussion, was adopted and a resolution was passed pledging the meeting to do their utmost in helping the directors in raising the required capital, and strongly urging upon the directors to subscribe according to their present interest in the company.

NICTHEROY (BRAZIL) GAS COMPANY, LIMITED.

The Annual General Meeting of Shareholders was held at the Company's Offices, No. 5, Great Winchester Street Buildings, London, on Tuesday, May 23—Mr. C. PENNEL in the chair.

The SECRETARY (Mr. W. W. Wright) read the notice convening the meeting, and the following report was presented:—

The directors have to report that the results of the working of the company during the past year show an improvement beyond that of 1874. The revenue has been increased by £2260, with but £550 additional expenses.

Due care has been exercised in supervising the expenditure, in order to reduce it as far as is compatible with efficient working. In furtherance of this object, the frequent visits paid to the works by Mr. Gotto, your director, in company with Mr. Neate, while they were in Rio on other business, have been most beneficial. The company's engineer reports that ample appliances now exist at the works for the extinction of fire, and a resolution will be submitted to the shareholders at the meeting with the view of discontinuing the insurance, which will effect a saving of £90 per annum.

The annexed statement of accounts shows that, after setting aside £1000 to reserve account, the profits for the year are £3174 0s. 7d., which, with the £1678 6s. 3d. brought forward from 1874, makes a total of £4852 6s. 10d. to the credit of profit and loss account. The directors recommend a dividend of 5 per cent., to be paid when sufficient debentures or shares authorized to be issued are placed, there being no funds in hand available for the purposes of a dividend. A copy of the original prospectus of the debentures, with an application form, is sent you herewith. The company's business having become extended, it is necessary to the satisfactory working of the undertaking that the debenture capital be completed; and the directors would now be glad to receive application for the balance of £6400.

Dr. *Revenue Account, Dec. 31, 1875.* *Cr.*

Coals carbonized	£6,501	15	7	Gas supplied to street-lamps	£10,668	12	2
Purifying materials	25	2	6	Less fines	95	6	9
Carbonizing wages	751	7	11		£10,573	5	5
Yardmen and labourers	486	1	5	Public buildings	475	4	11
Lamplighters and inspectors	954	8	11	Private consumers	3,476	18	5
Salaries and commissions	969	3	4	Residual products	2,164	16	7
Agency in Brazil	750	0	0	Fittings	540	1	4
Honorarium to concessionaire, pursuant to arbitration award	250	0	0				
Maintenance	447	12	7				
Insurance of works	90	0	0				
Brazilian taxes	111	5	2				
Directors remuneration	500	0	0				
Office expenses in London and Brazil, including secretary	460	10	9				
General expenses in London and Brazil, including postage and receipt stamps, and telegrams	215	11	5				
Reserve for doubtful debts	250	0	0				
Auditors	21	0	0				
Interest on £3600 of 7 per cent. debentures	232	2	3				
Interest on loans	30	17	8				
Income-tax	9	6	7				
Amount carried to reserve to cover depreciation and cost of concession	1,000	0	0				
Balance, being profit for the year	3,174	0	7				
	£17,230	6	8		£17,230	6	8

[Attached to the directors report was a report by Mr. Charles Neate, the company's consulting engineer, as to the state of the works, &c.]

The CHAIRMAN, in moving the adoption of the report, said that it informed the shareholders that the company were advancing. It was true they had not yet quite overcome the difficulties which opposed them, but they were now moving on a road which promised, before long, to lead the company into a more comfortable position. From the commencement the company had felt embarrassment from not possessing sufficient capital, and the capital which they did possess had been reduced yearly by the extension of works which, by their contract with the Brazilian Government, the company were bound to undertake whenever required to do so by the Provincial Government. The company obtained on the issue of shares and debentures the sum of £85,600; on the other hand, there had been expended in the erection of works, &c., £79,780, whilst most of the difference was represented by stock in hand, leaving a balance of something less than £400 for working capital, which, of course, was insufficient for the operations of the company. He could quite believe many of the shareholders might say that the company were not progressing; they might reasonably state that in 1873 there was no dividend; in 1874 there was no dividend; and now again in 1875 there was no dividend; and they might fairly ask in what respect the company had improved. In reply, he might remind them that in 1873 and 1874 the business of the company was carried on, in a great measure, by money borrowed on the personal guarantee of the directors, whereas in 1875 that guarantee was only required to a small extent at the beginning of the year, and it would be seen that the net earnings of the company had increased, though no doubt it was trying to the feelings of the shareholders to postpone the payment of dividends which had been earned. The success of the company, in certain respects, had not corresponded to the expectations of the directors, chiefly from reasons which they were unable to control. In the first place, the private consumption of gas in Nictheroy, compared with the public consumption, was very much less than was the case in all other towns in which gas had been introduced. In Rio de Janeiro, a distance of three miles, the private consumption more than doubled the public, whilst in Nictheroy the private consumption was less than one-third of the public. As a rule, in all towns, the private consumption equalled or exceeded the public; and he thought that, in the course of time, the rule which held good in other places would also hold good in Nictheroy. When that took place—*i. e.*, when the private consumption equalled the public consumption—he believed that, from that source alone, the company would get an increased net profit of 2 per cent. Two or three years ago a shareholder proposed the liquidation of the company, at the same time expressing a conviction that, so hopeless was the state of their affairs, that if the shareholders wished to save any of their property, they should undergo immediate liquidation, and he made a motion to that effect, which fell to the ground. Before leaving the room the shareholder declared his intention of consulting a solicitor, with the view of forcing the company into liquidation. Now, he thought that shareholder, if present, would admit that considerable progress had been made since. In 1875 the company made a profit of nearly 4 per cent., after setting aside £1000 to the reserve account. Under such circumstances, he thought no one would for a moment entertain the idea of liquidation. If they compared the last three years, they would find that, in 1873, the profits were nothing; in 1874, £2700; and, last year, they amounted to £4170, showing a rapid progress—a progress so considerable, that they could scarcely expect to see it go on at the same rate in the future; though, of course, they might still look for considerable improvement. In issuing the first prospectus the directors—of whom only two of the original now remained—had been accused of misrepresenting facts, and misleading shareholders into the belief that the company would gain much larger profits than had been the case. The directors, in issuing the prospectus, were careful to state fully and clearly the grounds upon which the estimate of profit was based, and they furnished to each proposed shareholder the same means for calculation which they themselves possessed, and every one was in a position to form a judgment for himself on the point, and he supposed no one had taken shares unless he agreed with the directors that the calculations were correct. He, therefore, thought it was unfair to charge the directors with having misled the shareholders; the mistake had been mutual, and had been produced by a variety of unfortunate circumstances which combined to upset the calculations. He would mention a few of those circumstances. In the first place, as he had already stated, the use of gas for private consumption in Nictheroy was less than was expected. Then the price of labour in Brazil, and, indeed, almost all over the world, had increased. Again, the company sustained expense by the death of their manager, Mr. Pitman, who possessed the full confidence of the board, and who, after less than a year's residence abroad, fell a victim to yellow fever. Another reason was that the price of coal had risen to an unprecedented height. The first cargo of Wigan cannel coal sent over cost 21s. per ton; but the price shortly afterwards rose to 30s., 40s., and even 50s. per ton. For some time it was impossible to obtain that coal for less than 40s. per ton, and now it was not possible to obtain it at all. He believed reasonable grounds existed for the belief that 1876 would show still greater progress, and he entertained the strongest hope that next year the shareholders would be able to congratulate each other upon the improved prospects of the company.

Mr. MARTINEAU, a director, seconded the motion.

Mr. DODGSON said he thought the suggestion in the report, that the shareholders should apply for the balance of £6400 of debenture capital, which would set free sufficient of the earnings for the payment of a dividend, was not sound financial policy. He suggested they should not divide any of the balance brought forward from the previous year, but should simply limit the division to the profits of last year—namely, £3174—and he would propose to the shareholders that they should take the dividend in the form of unallotted shares at par. This would absorb the larger portion of the unallotted shares, and the directors would have no difficulty in getting out the remainder.

Mr. KEY asked what number of shares the directors held as a qualification, and whether the shares they held were paid up in full.

The CHAIRMAN said the qualification was 100 shares, and the directors had fully paid for every share they held. In answer to Mr. Dodgson, he said the money for the payment of the dividend was earned, but there was no cash in hand to pay it, the money being required to carry on the works. The company had about £7000 owing to them by the Provincial Government and private consumers, all of which he considered good; and, of course, if that money were in the coffers of the company, the dividend could be paid at once. With respect to the suggestion of dividing the amount in the shape of shares at par, there was a good deal to be said in its favour, and it had been already discussed by the board, but, owing to the number of small shareholders, there was considerable difficulty in the *pro ratâ* distribution of shares.

Mr. DODGSON said the consolidation of fractional parts of shares into one share would meet the difficulty.

The CHAIRMAN said the board were glad of any suggestion from shareholders, and if the meeting were favourable to the suggestion of Mr. Dodgson, they would do all in their power to carry it out. Alluding to the suggestion in the report relative to the discontinuance of insurance of the works, by which about £90 a year would be saved, he said that such ample appliances now existed at the works for the extinction of fire, that it was considered scarcely necessary to continue the expense of insurance; however, that was a question which the directors wished the shareholders themselves to decide. In reply to another inquiry, he stated that the number of houses in Nictheroy was increasing, but not rapidly; yet it was an important fact, that the houses were of better quality, and, therefore, more likely to use gas, which was used but little by the poorer classes.

Mr. SCOTT thought something should be done in the way of reducing the expenditure. The management expenses were close upon £3000, which he considered to be excessive. He had heard that the quality of the company's gas was so bad that, on the occasion of a *réunion* of presidents, candles were obliged to be resorted to. If the gas was bad in quality he could quite understand why the private consumption did not increase.

The CHAIRMAN said the question of expenditure had been a cause of great anxiety to the directors, and they had used every effort to reduce it. As compared with other companies, however, it was not excessive, and he did not see how in any special manner it could be diminished.

Mr. DODGSON referred to the item of "Agency in Brazil, £750," which he thought was a very large sum to pay for the collection of a rental of £17,000.

The CHAIRMAN, referring to the statement of Mr. Scott, said the directors heard from every quarter that the gas supplied was very good, that it was better in quality than required by the company's contract with the Government, and that it gave satisfaction to the public. As to the particular instance named, he was inclined to think the fault was in the fittings.

Mr. GOTTO said, when in Rio last year he had the opportunity of visiting the company's works, and seeing the quality of gas supplied, and he had no hesitation in saying that the quality was very superior (as was evidenced, indeed, by the few fines they had to pay), and also that the manufacture was economically conducted. As to the future of the company, there was no doubt that the construction of the railway terminus in Nictheroy would still further develop the place, and there could be scarcely a doubt that the private consumption of gas would increase year by year. From all he knew of the company, he could not help thinking they were now on the road to success, and that they might look forward, year by year, to an increase in dividends. He fully agreed with Mr. Dodgson's suggestion, that the shareholders should take the dividend in the form of shares at par, because this would supply the company with what they wanted—namely, a certain amount of floating capital, and get them out of their difficulties.

After some further conversation on the question of the expenditure, the motion for the adoption of the report was put and carried.

Mr. SCOTT repeated that in his opinion the amount of expenditure was not satisfactory, especially in reference to the items of directors fees, salaries, &c., which amounted to £2898, and he thought a considerable reduction should be made hereafter in these items. He moved a resolution to the effect that the directors be requested to go into the matter of expenditure, and suggest some means by which it might be brought within more reasonable limits.

Mr. KEY seconded the motion, which was put and carried; whereupon Mr. MICHOLLS and Mr. GOTTO intimated that they should resign their seats at the board.

Mr. NEATE gave some explanations respecting the departure from the original estimates for the works, &c.

The CHAIRMAN, in reply to a question, said that as the meeting had adopted no resolution for discontinuing the fire insurance, the directors would feel bound to keep up the policy.

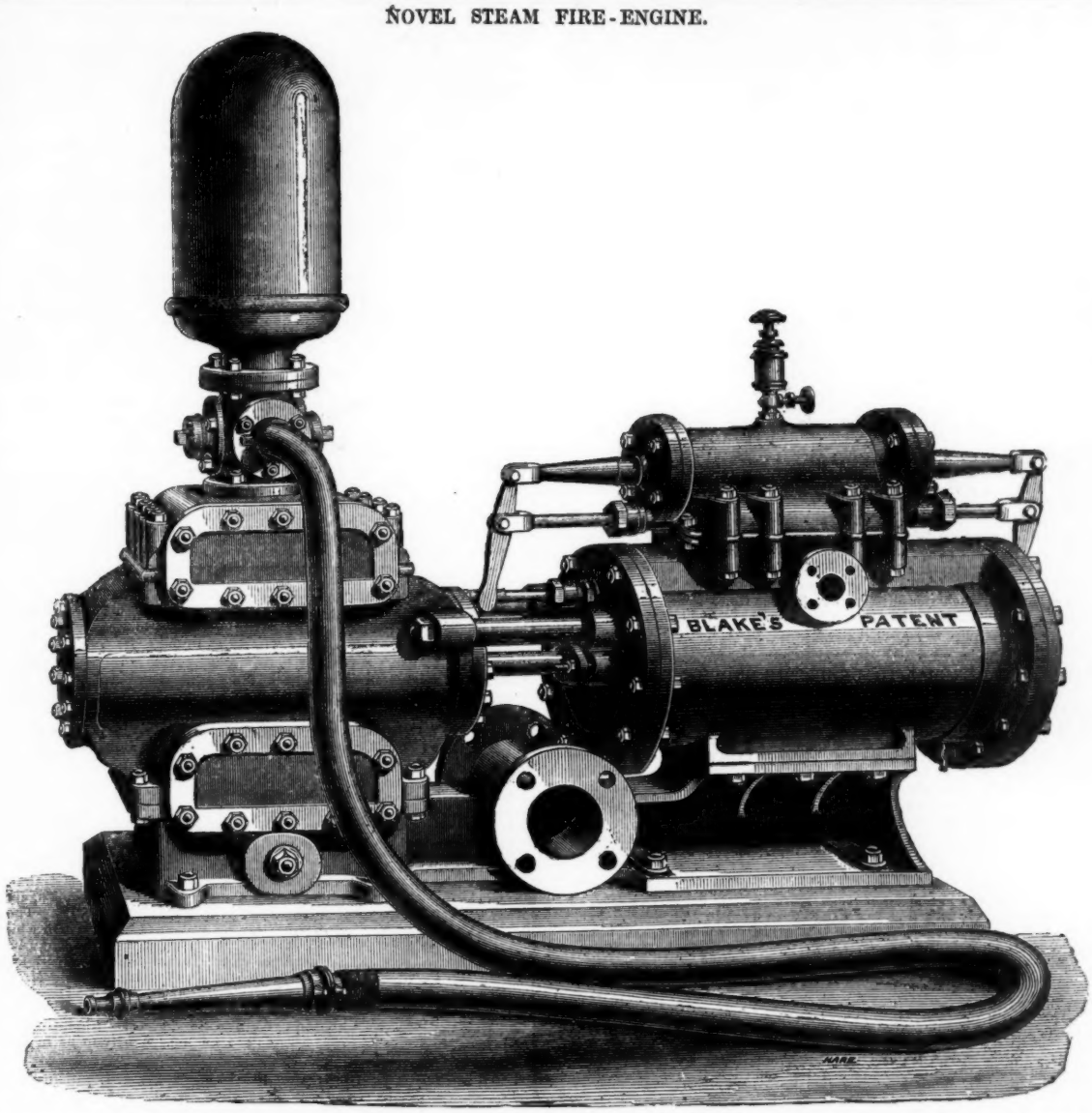
Some conversation ensued respecting the resolution just adopted, the mover and seconder protesting that it was not proposed as a motion of want of confidence, nor with the idea that any of the directors would resign if it were carried. Upon this explanation it was understood that Messrs. Micholls and Gotto withdrew their resignations.

The following resolution was then adopted:—"That a dividend at the rate of 3½ per cent. for the year 1875 be now declared, and that the same be paid in shares at par—viz., 287 shares of £10 each, and that fractional certificates be issued in the proportions necessary, which, when consolidated, shall be duly entered upon the register."

The proceedings closed with a vote of thanks to the chairman and directors.

BIRKENHEAD COMMISSIONERS GAS AND WATER WORKS.—At the meeting of the commissioners, on the 30th ult., the annual accounts were presented. From the accounts of the Gas and Water Department, it appeared that the total receipts for the year ended the 31st of March last amounted to £68,982, and the expenditure to £64,873, showing a balance of £4109.

NOVEL STEAM FIRE-ENGINE.



Our engraving represents a steam fire-engine just completed by Messrs. S. Owens and Co., of Whitefriars, upon the principle of the Blake Direct-Acting Steam-Pump. It has been manufactured to the order of the Russian Government, and is intended to be fitted in an iron steamboat for use as a floating engine on the Neva. We had an opportunity, during the past week, of seeing some trials of this engine, which were made before Captain Shaw, of the Metropolitan Fire Brigade, and many leading scientific men, on the site of the works of the late City of London Gas Company, and the results of those trials seemed eminently satisfactory. Blake's patent pump is well known in connexion with mining operations, and for water-works purposes in the United States, where it is extensively used as a fire-engine as well as for ordinary pumping. It has, within the last year or so, been introduced into this country by Messrs. Owens, and its simplicity, compactness, and non-liability to derangement will doubtless be strong recommendations in its favour. By the combination of valves, the action of the pump is rendered continuous at all pressures, and at any rate of speed, without a dead point. The engine now on view has a 14-inch steam cylinder, and a pump cylinder 8 inches in diameter, with a 24-inch stroke. It has a 6-inch suction, and a 5-inch delivery, with two branches for 2½-inch hose. In the trials at Whitefriars, two 70-feet lengths of ordinary fire-hose were employed, and with 40 lbs. steam, running 44 double strokes per minute, two powerful streams were projected through 1-inch jets a height of about 130 feet, and with 1¼-inch jets a horizontal measured distance of 129 feet was attained. We believe the engine will remain in London a short time longer, and it would be well if members of the British Association of Gas Managers, who may be in town next week, were to embrace the opportunity of seeing it in action.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

A great deal of attention has been attracted during the week to the possible consequences of the peculiar complications in Eastern Europe. It is felt that the "situation" is very serious, and may result in a war in which England may have to take a leading part. That result would of necessity tend to a greater depression of trade than already exists throughout the whole country, although it would doubtless have a tendency to keep some of the special trades of Sheffield busily engaged. On all sides here, however, every confidence in the governmental course is expressed, and it is thought that their dignified and impressive action will conduce to a peaceful result. Pending what may "turn up," to use a Micawberish expression, in the course of the next few days, there is literally no business doing in merchant iron, the various kinds of which are, if anything, again a little weaker in price, a common bar being obtainable at £7 per ton. Pig iron of all qualities is not sought after, owing to the dulness of the manufactured branches, and North country general brands are held by agents at about the following nominal figures:—No. 1 foundry, 49s. 6d.; No. 2 foundry, 47s.; No. 3 foundry, 46s.; No. 4 foundry, 45s.; No. 4 forge, grey, 44s.; No. 5 forge mottled, 43s. 6d.; No. 6 forge white, 43s.; refined metal, 63s.; Kentledge, 53s.; and cinder pig, 37s. 6d. All net cash at works.

The difficulties under which iron manufacturers are carrying on business are pretty well exemplified in the case of William Cooke and Company, Limited, whose directors issued their report on Friday last. That document shows that the loss on last year's trading was over £12,000, and states that trade is unprecedentedly bad.

Mr. John Clutton, of Whitehall Place, London, arbitrator, has just made his award in respect of the claim of Mr. Bosville, of Ravenfield Park, against the Corporation of Doncaster, for £25,000, for land, residential injury, &c., &c., caused by the construction of new water-works reservoirs. The question of mineral rights having been allowed to stand over, Mr. Clutton has awarded £7500.

At the time of writing, the strike of miners in South Yorkshire is still unsettled, albeit another interview has been arranged between the men and the associated masters. The men must now be in an exhausted condition financially, and they are beginning to see that a longer resistance will only result in further reductions shortly. Their representatives have accordingly made offers which are nearer the masters terms than any yet made.

There is no scarcity of coal, an abundance being sent here from Derbyshire, Staffordshire, and Lancashire.

IRON AND COAL TRADES OF SOUTH STAFFORDSHIRE AND EAST WORCESTERSHIRE.

(FROM OUR OWN CORRESPONDENT.)

The iron trade of this district still rules dull in nearly all the leading departments, but owing to the advent of the Whitsuntide holidays some slight increase of activity has been noticeable during the past week; makers, as a rule, being anxious to clear off all specifications before the works were closed; there is apparently no real improvement in the actual condition of affairs, and the prospects of business are still gloomy, and few of the works are doing, on the average, more than three days per week. Sheets continue in leading request, and galvanized roofing sheets show a tolerably steady demand.

Makers of common unmarked iron, who are dependent chiefly upon local consumers, are very badly off for orders, and prices in this department of the trade are very weak and irregular. Transactions are reported on the basis of £7 per ton for bars, which under existing conditions of production must necessarily allow only a very slender margin of profit. The best brands of marked iron are still firm on the basis of £9 per ton for bars. In pig iron, current quotations show the same remarkable disproportion between the best and the inferior qualities of produce, the prices ranging from £2 12s. 6d. per ton for common cinder to £5 10s. for cold blast native all-mine makes, and while the rates for the better qualities are steadily upheld, the common descriptions are pressed for sale at gradually weakening prices.

Mr. Samuel Roberts, of the well-known Sponhave Foundry, has this week patented an apparatus for the manufacture of cast flanged pipes on an improved method.

In the coal market, though the demand can scarcely be described as more active, it is certainly steadier than last reported. The resolution of the mine-owners in the Bilston district to abandon entirely the drainage operations which have been in progress for some time past, and which they now find too costly, has caused some little anxiety as to the future supply of coal in that district, as their decision will probably involve the flooding of the mines over a very large area.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

Trade in this district, both as regards iron and coal, has during the past week been very dull, and there is a good deal of pushing to effect sales, with a weakening tendency in prices. All descriptions of round coal are difficult to move, with the exception that those for gas-making purposes continue to be inquired for, and there are a number of gas companies contracts now in the market. But even for these there is a very keen competition, which, as I have anticipated in previous reports, is having a very material effect upon prices, and the position of the market is at present very favourable to consumers. Nominally, rates are the same as those which have been previously quoted, but there is so much underselling that they cannot be regarded as the prices at which the bulk of the business is being done. For house coal, the demand from merchants and dealers has fallen off considerably. Common coal and fuel for iron-making purposes is extremely flat. Burgy is in less request, and slack, although qualities suitable for brick-making are still in good demand at full prices, has been rather more plentiful. The pit quotations are without any material change from those which have been ruling during the past month, although there is rather an easier tone in the market.

The shipping trade continues very dull; very few cargoes are being sent out, and these at very low prices.

For coke there is still very little demand, and prices have a downward tendency.

In the iron trade there is no material change to notice. Sellers continue to give way in their prices, without bringing more business into the market. Both in pig and manufactured iron there is a good deal of underselling to secure orders, and there is no immediate prospect of improvement in the trade. Makers quotations are about 58s. 6d. per ton for No. 3 Lancashire pig, 57s. 6d. for No. 4 forge ditto delivered into the Manchester district, 54s. 9d. for No. 3 Middlesbrough, and 53s. 9d. for No. 4 forge ditto delivered, but lower prices are quoted by merchants, who, in some quarters, are endeavouring to "bear" the market.

THE COAL AND GENERAL TRADE OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

There was a moderate demand last week for households, for London and the coast, from the Tyne and Wear, and also a fair demand for steam and gas coals; manufacturing coals, however, still continue very dull, with little prospect of improvement; prices for all classes are very low, and even for best qualities are not remunerative. Most of the pits were kept going full time last week, but owing to the holidays there will be comparatively little doing during the early part of this week. The demand of the coalowners for a reduction of 10 per cent. in miners wages is causing some little uneasiness, but it will probably be settled by arbitration. There has been a slight dispute at Ryhope Colliery, one of the largest in the Wear district, resulting in the turn-out of the men, but it will probably soon be arranged.

The demand for tonnage has improved, and rates are firmer for the upper and lower Baltic ports. For the Mediterranean there is little doing, and rates are very dull. For London, several steamers have been fixed in the Wear at 4s. 6d. and 4s. 9d., and there are inquiries for time charters at the latter figure.

In the iron district of Cleveland and the North of England no improvement has shown itself. Pig iron has shown a downward tendency. Ironfounders are fairly supplied with orders. The finished iron trade continues very dull, and few orders are on hand.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

News has arrived in Glasgow to the effect that a special meeting of the Select Committee on Sir Windham Anstruther's Gas Supply Bill was held last Tuesday, and that the result of the proceedings was complete satisfaction to the representatives of the city of Glasgow. As previously recommended to the House of Commons by the committee, the bill did not sufficiently protect the Glasgow Corporation, as the proprietors of gas-works, with statutory powers and corresponding obligations. The sitting was private, but it was understood that the committee had transformed the bill back to its original shape, by limiting its scope to non-incorporated companies, so that all gas companies in Scotland which exist under statutory powers are now placed outside the operations of the bill. The populous district of which Glasgow is the centre thus remains under the existing arrangement as to gas supply; and the corporation, while bound by obligations on the one hand, will continue free from interference by any rival local bodies within the district. It may be remarked that Sir W. Anstruther's original intention of enabling populous places to set up their own gas-works where no statutory company already occupy the ground, is thus confirmed by the committee, who practically, it may be said, pass a vote of censure upon themselves for having changed the scope of the bill; and thus it remains as originally intended, a bill for small burghs and populous places. Town Councils or Commissioners of Police are thereby enabled to set up gas-works where they do not exist, or to purchase existing works which are not protected by statutory powers, though, of course, the existing companies must first be bought up, if willing to sell, and cannot, therefore, be superseded without due compensation. Later news says that the bill is now printed in its re-amended form, and that it contains the following clause:—"The provisions of this Act shall not empower the Town Council or Commissioners of Police of any burgh in which this Act shall be adopted, or Commissioners under this Act, to supply gas within any part of the area of supply over which the Town Council or Commissioners of Police of any other burgh, or any gas company incorporated by Act of Parliament, shall have statutory powers to supply gas at the date of the adoption of this Act in such burgh."

The Corporation Gas Commissioners of Dundee have announced good news to the consumers of gas in that town. At present the price of gas is 5s. per 1000 cubic feet, or 4s. 9d. in the event of the accounts being paid within 28 days after being rendered, and henceforth it is to be brought down to 4s. 5d. per 1000 feet, and if the accounts are promptly paid the price will only be at the rate of 4s. 2½d. per 1000 feet. The accounts for the year ending the 30th of April, 1876, have been made up, and while the total expenditure amounted to £61,151, the total revenue was £61,588, thus leaving a very favourable balance. As the affairs of the Gas Commissioners for the past year have been so very favourable, and as the price of coal has fallen very materially, it is thought that such a large reduction in the price of gas may be made both with confidence and with advantage. Unless some unexpected change occurs, it is confidently believed that the reduction now to be made will be maintained. The annual general meeting of the Gas Commissioners will be held on Wednesday, the 21st day of June.

On Thursday last, the annual general meeting of the shareholders of the Dunblane Gas Company was held—Mr. John Stirling, of Kippendavie, in the chair. After the annual report was submitted, and some remarks made upon it, it was agreed to adopt the recommendation that a dividend at the rate of 10 per cent. be declared for the year ended at Whitsunday last. The directors announced their intention to reduce the price of gas from the 1st ult. by 1s. 8d. per 1000 cubic feet.

At two of the stations of the Glasgow Gas Commissioners the illuminating power of the gas was up, respectively, to 30·39 candles, and 30·64 candles. The average over the four stations ranged from 27·20 candles (at Dawsholm) to 29·08 candles (at Tradeston). The Dalmarnock gas had 14·09 grains of sulphur per 100 cubic feet, and ·29 grains of ammonia, whereas the quantities at the Partick station were, respectively, 21·61 grains, and ·77 grains per 100 feet.

The last report which I have of the illuminating power of the Perth gas states that the result of three experiments was—maximum, 25·49 candles; minimum, 24·21 candles; and average, 24·82 candles.

Professor E. J. Mills, F.R.S., of the Young Chair of Technical Chemistry, has, at the earnest request of Dr. Frankland, resumed the periodical examination of the Loch Katrine water, formerly carried on by his predecessor, Professor Gustav Bischof, now of London. His first report of the results obtained over the past three months gives somewhat elaborate details, especially on the vexed question (among chemists) of organic carbon and organic nitrogen.

A special meeting of the Hawick Town Council was held last Tuesday, to consider Messrs. Leslie and King's report on the proposed drainage scheme for the burgh. In a supplementary report, the estimated cost of the works of purification was stated at £4000, and the working expenses at £2 10s. to £3 per day. It was considered inadvisable to come to a resolution on the reports until an estimate was also made of the drainage of the town, and the master of works was instructed to have that done.

At their monthly meeting, held last Thursday, the Dundee Water Commissioners initiated a very important scheme for the scouring and flushing the drains of that town, and of the adjacent burgh of Broughty Ferry.

The price of pig iron has ranged during the week between 58s. and 57s. 9d., but there has been comparatively little business done.

In the Glasgow district the coal trade is very inactive, although there are some shipments of considerable extent recorded; but in the East of Scotland the pits are kept pretty busily employed. Some of the miners are preparing to emigrate from Fifeshire; indeed, many have already left for Glasgow and Liverpool, from which ports they are about to sail.

DUDLEY PUBLIC LIGHTING.—It is stated that the Public Works Committee of the Dudley Town Council are about to substitute petroleum for gas in lighting the public lamps of the borough.

REDUCTIONS IN THE PRICE OF GAS.—The price of gas at Abingdon was reduced on the 1st ult. from 5s. 10d. to 5s. At a meeting of the Finance Committee of the Dundee Gas Commission on the 29th ult., it was resolved that the price of gas this year should be 4s. 5d., with 5 per cent. discount, being a reduction of 7d. At Totnes the price has been reduced from 6s. 3d. to 5s. 10d.

DRAINAGE OF THE THAMES VALLEY.—At a conference of local authorities on the north of the Thames, held at Brentford on Thursday evening last, the following resolution was adopted:—"That this meeting is of opinion that, seeing the difficulties which surround the adoption of any scheme of drainage in the present state of legislation, it is desirable that representations by the various local authorities below the intake of the metropolitan water companies be made to the Home Secretary, for the purpose of ascertaining whether the Government are prepared to recommend the appointment of a Royal Commission upon the subject."

RATING OF THE SOUTHAMPTON GAS-WORKS.—In January last the Southampton Gas Company appealed to the Court of Quarter Sessions against the rating of their property by the Board of Guardians in July, 1875. The chief point in dispute arose with reference to the parish of St. Mary, in which the mains, stations, and works, and wharf of the company, were rated at £4650, the former rating being £1925. When the case came before the Recorder for hearing, it was, by consent of both parties, referred to the arbitration of Mr. George Pownall, with full power to him to state a special case for the Queen's Bench on any point on which he might be required by either party to do so. The learned arbitrator opened his inquiry at the Surveyors Institute, Great George Street, Westminster, on the 22nd ult., and we hope shortly to be in a position to give a report of the proceedings.

BATH NEW WATER-WORKS.—On the 10th ult. the corporation celebrated the completion of the new city water-works. The works were commenced in 1870, and their carrying out has altogether, with the purchasing of land and the paying of compensation for loss of springs and water power, cost £100,000. The system adopted has been to collect a large number of springs in the valleys below Marshfield, and conduct the water, by means of mains, a distance of eight miles to the city, where there is a pressure sufficient to throw water, in case of fire, as high as the highest houses in the centre of the city, and to force an adequate supply for domestic use nearly up to the highest portions of the city. The springs are not caught at the surface, but have been traced to the spot at which they escape from the oolitic rock. A supply has thus been obtained of the utmost purity, and so constant that only small reservoirs for storeage are required. The yield of the new springs, together with that of the old works, furnished an average supply of 30 gallons per head per diem for the 60,000 inhabitants of Bath. On the 16th ult. the water was turned into the new reservoir, and the mayor (Vice-Admiral Paynter), in honour of the occasion, entertained the council to luncheon. The works were carried out by Mr. Alfred Mitchell, city engineer.

SOUTH SHIELDS GAS COMPANY.—The ceremony of laying the foundation-stone of new and extensive gas-works at Jarrow, belonging to the South Shields Gas Company, took place on the 15th ult. The very great increase in the population of the district supplied by the company has had the effect of rendering the present works at South Shields much too small to supply the demand for gas, and the directors some time ago resolved upon the erection of works at Jarrow. These works have been in progress for some months, but the laying of the corner stone was the formal celebration of the commencement of the undertaking. The new works are situated in close proximity to the Tyne General Ferry Company's boat-landing, and occupy a considerable area of ground lying at the foot of Union Street and Ferry Street. They are constructed in three parallel lines, the purifying apparatus being on the west side, the centre containing the large retort-house; the two large gasholders are situated at the east end. The tanks of the holders are substantially built of bricks, lined out with cement. The diameter of each is 93 feet, and the depth 27 feet. One of these holders has been completed and placed in position, it having undergone a few months ago a satisfactory testing. The holder is made in two lifts, each of which measures 90 feet 9 inches in diameter and 20 feet in depth, making, when filled, an elevation of 52 feet above the level of the ground, and having a storeage capacity of 400,000 feet of gas, being equal to the aggregate capacity of the three holders at the Shields works. The holder has been supplied by Messrs. C. and W. Walker, of Donnington, Salop, and London. Situated to the north of the gasholder is a chimney, recently completed, 91½ feet in height, and surmounted by light ironwork, which has a very striking and handsome appearance. The retort-house, now partially constructed, measures 160 feet in length and 40 feet in breadth. The walls of the works are principally of concrete, with pillars of fire-brick at distances of nine feet apart. At the base of the works, and at right angles to the other works, will be the machinery, workshops, offices, &c. All the latest modern improvements in the manufacture and purification of the gas will be introduced, and so far as possible the work will be done by machinery. The construction of the works is being carried out under the general superintendence of Mr. W. J. Warner, the engineer of the company.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION has been AWARDED to

GWYNNE & BEALE'S PATENT IMPROVED GAS-EXHAUSTERS,

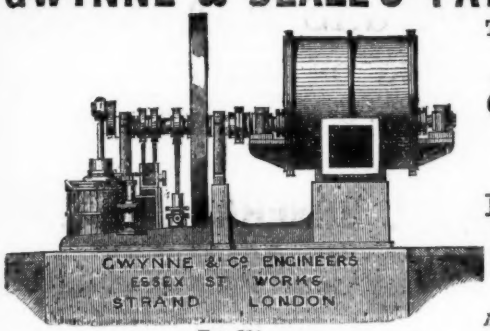


Fig. 224.

The BEST EXHAUSTERS IN THE WORLD.

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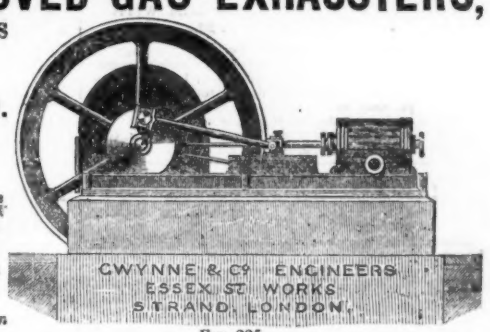


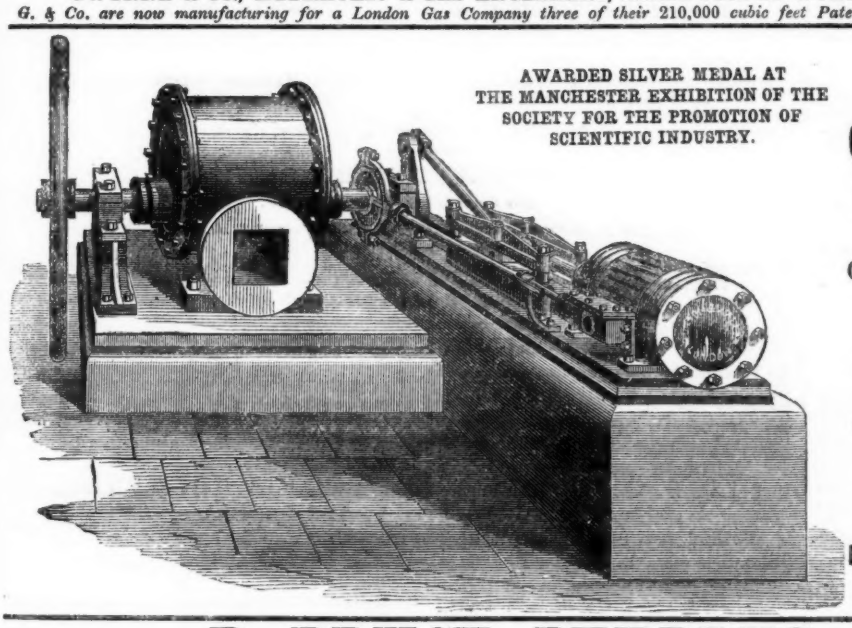
Fig. 225.

Fig. 224 represents one of those erected at the Imperial Gas-Works, Bromley, capable of passing 210,000 cubic feet of gas per hour. Several others of the same size are now on order for the same Company. These Patent Machines combine the highest quality of workmanship and materials, the largest bearings and wearing surfaces, with the **most perfect system of action yet discovered.** Fig. 225 represents one of a series of four at the Nottingham Gas-Works, each passing 52,500 cubic feet per hour. GWYNNE AND Co. *do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality, and the most approved design and arrangement.* Their prices have been estimated with a due regard to the **excellence of the article produced,** and when this is taken into consideration, they have no fear for the result. The orders executed this season for Exhausters and alterations to their patented system amount to over 4,000,000 cubic feet of gas passed per hour, and to over 300 horse power for Engines to drive them. In every instance their work is giving the greatest satisfaction. Numerous testimonials and references can be given.

REGULATORS, BYE-PASSES, STOP-VALVES, GAS-VALVES, & MACHINERY FOR GAS MANUFACTURE, OF ALL SIZES, CAN BE HAD ON APPLICATION TO

GWYNNE & CO., HYDRAULIC & GAS ENGINEERS, ESSEX STREET WORKS, STRAND, LONDON, W.C.

G. & Co. are now manufacturing for a London Gas Company three of their 210,000 cubic feet Patent Gas Exhausters, and many of all sizes.



AWARDED SILVER MEDAL AT THE MANCHESTER EXHIBITION OF THE SOCIETY FOR THE PROMOTION OF SCIENTIFIC INDUSTRY.

BEALE'S

Improved Patent

GAS-EXHAUSTERS

WITH

ENGINES COMBINED.

Sole Makers,

GEORGE WALLER & CO.

Makers of

ENGINES, EXHAUSTERS,
INDEX and DISC GAS-VALVES,
HYDRAULIC MAIN VALVES,
BYE-PASS VALVES,
TAR, LIQUOR, and other PUMPS,
SCRUBBERS and PURIFIERS,
CONDENSERS, BOILERS, &c.

PHŒNIX ENGINEERING WORKS,

HOLLAND STREET, S.E.,

AND

STROUD, GLOUCESTERSHIRE.

D. BRUCE PEEBLES & CO.,

ENGINEERS,

FOUNTAINBRIDGE WORKS, EDINBURGH,

MANUFACTURERS OF WET AND DRY GAS-METERS;

Patentees and Sole Manufacturers of PEEBLES' LAMP-GOVERNORS,

ABOVE 30,000 OF WHICH ARE NOW IN USE.

"These Lamp-Governors are so superior that they are likely to supplant all others."—*Dr. Wm. Wallace, F.R.S.E., F.C.S.*

D. BRUCE PEEBLES AND CO., FOUNTAINBRIDGE WORKS, EDINBURGH.

WANTED, a steady Man, to take charge of a small Gas-Work.

Applications, with testimonials, to be sent on or before the 15th inst., to C. H. FIFIELD, Rothwell, near KETTERING.

WANTED, a situation as Working MANAGER in a small country GAS-WORKS. Is thoroughly acquainted with the manufacture and distribution of gas, retort-setting, main and service laying, &c. Twenty years experience. Eleven years in present situation.

Address T. CRESSWELL, Gas-Works, Cuckfield, SUSSEX.

WANTED, by a thoroughly practical Man, who will shortly be disengaged, a re-engagement as MANAGER of a Gas or Gas and Water Works. Is well experienced in every department. Can produce first-class testimonials and references.

Address No. 265, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ADVANTAGES OF GAS FOR

COOKING AND HEATING.

HINTS ON GAS BURNERS, &c.

By MAGNUS OHREN, A.I.C.E., F.C.S.

Specimen Copy by post Threepence, direct from MAGNUS OHREN, Gas-Works, Lower Sydenham, London, S.E.

WANTED, by the Advertiser, a situation as GAS-FITTER, Main and Service Layer, Meter Inspector, or to take charge of small works. Good references. Would have no objection to go abroad.

Address, G. K., 2A, George's Place East, Russell Street, BERMONDSEY, S.E.

WORKING FOREMAN Wanted at the Beccles (Suffolk) Gas-Works. One capable of taking meters. Wages 25s. per week, with good cottage and garden. Coal and gas found. Must be a sober, industrious man, and able to produce good references.

Apply to Mr. J. WATERMAN, Manager, Station Road BECCLES.

REQUIRED, a sober steady Man as STOKER. Constant employment. Wages 24s. 6d. per week. Overtime paid.

Address, in own handwriting, with reference for character, No. 269, care of Mr. King, 11, Bolt Court, Fleet Street, LONDON, E.C.

FOR SALE—One 9-in. Governor, by Milne, with or without valves and connexions.

One 6-in. CONDENSER, 24 pipes with bends and flanges at top and syphon-box at bottom, 2 ft. 3 in. by 2 ft. and 14 ft. long.

The above are in first-rate condition, and may be seen at work. Are being removed to make room for larger.

Apply to JOHN CREW, Corporation Gas-Works, BLACKPOOL.

WANTED, by a young Gentleman, an appointment as SUB-ENGINEER or MANAGER. Has no objection to going abroad.

Address No. 270, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

A Young Gentleman, who is at present lessee of Gas-Works, but whose term expires shortly, wishes to meet with an engagement either as CLERK or SUB-MANAGER. Excellent references. Salary not so much an object of consideration.

Address No. 271, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ON SALE—One Round Station-Meter, to pass 12,000 feet per hour, with 8-in hydraulic valves and bye-pass. Will be thoroughly overhauled and fitted with new drum.

Apply to J. AND J. BRADDOCK, Globe Meter-Works, OLDHAM.

FOR SALE—Six round Retorts, 8 ft. 9 in. by 13 in., lying at Corbridge Retort-Works (W. Walker's). Also a lot of 13-in Mouthpieces, 4-in. Ascension, Bridge, and Dip-Pipes, 12-in. Hydraulic Main, lying at Morpeth Gas-Works.

The above will be sold a bargain.

Apply to ROBERT WATSON, Manager, Gas-Works, MORPETH.

CATHELS'S IMPROVED

RETORT-SETTINGS.

GUARANTEED TO HEAT UNIFORMLY WITH THE MINIMUM OF FUEL.

Coloured lithograph copies of Working Drawings of beds, of 1, 2, 3, 5, 6, and 7 Retorts each, so clearly arranged and fully shown, as to be easily understood by any retort-setter or bricklayer, having just been made of these valuable settings, they can now be supplied with detailed specifications, immediately on receipt of orders.

Applications to be made to Mr. THOS. NEWBIGGING, Gas and Consulting Engineer, 5, Norfolk Street, MANCHESTER.

FOR SALE, in one lot, neatly half bound, uniform, GAS JOURNAL, Vols. 1 to 25, except volumes 4, 5, 6, 7. Highest offer will be accepted. Vol. 2 has portraits.

Address No. 268, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

THE Swansea Gaslight Company have for immediate SALE, the following Plant:—

A 6-h.p. Patent Trunk Engine. (Beale.)
Cylindrical Egg-ended Boiler, 20 ft. by 4 ft. 6 in. (Beale.)
Exhauster to pass 15,000 feet per hour. (Beale.)
An 8-h.p. Grasshopper Engine. (Easton and Amos.)
Cylindrical Egg-ended Boiler, 20 ft. by 4 ft. 6 in. (Easton and Amos.)
Exhauster, 20,000 ft. per hour. (Beale.)
Tar, Liquor, and Water Pumps, Eccentrics, Shafting, and Driving Pulleys.
Wrought-iron Condenser, six vertical Legs, 30 ft. high, 24 in. by 6 in., with tar-boxes, dips, and syphons.
Wrought-iron Scrubber, 5 ft. diameter, 20 ft. high.
Cast-iron Scrubber, 3 ft. diameter, 20 ft. high.
A set of four cast-iron Purifiers, 12 ft. square by 5 ft. deep, with galvanized wrought-iron covers, lifting apparatus, four tiers of wooden sieves, 10-in. connexions and valves.

May be seen at the Gas-Works, Swansea. The whole in perfect working order; replaced by plant of larger dimensions.

Further particulars may be obtained on application to Mr. THORNTON ANDREWS, SWANSEA.

MIRFIELD LOCAL BOARD.

TENDERS Wanted for 210 fluted Lamp-POSTS, with cast-iron lamps. Ten to have box meters. Not to weigh less than 2½ cwt. each.

Tenders, accompanied by patterns, to be sent to me not later than the 12th of June inst.

J. IBBERSON, Clerk to the Board.

June 2, 1876.

THE Director of the Catalana Gas Company of Barcelona is prepared to receive TENDERS for a Telescope GASHOLDER, Wrought-Iron Columns, and Girders, all free on board in any port.

The Gasholder being of a capacity from 8000 to 10,000 cubic mètres, and working under a pressure of about 80 millimètres.

Plans and specifications, with terms, to be submitted to the said Director, Mr. José Gil, at 13, Calle Ancha, Barcelona, Spain, on or before the 10th of June next.

The Director does not bind himself to accept the lowest or any tender, and reserves to himself the right of accepting the whole or any portion of one tender.

TO MANUFACTURING CHEMISTS AND TAR DISTILLERS.

THE Directors of the Ossett Gas Company invite OFFERS for the purchase of the whole of the AMMONIACAL LIQUOR and surplus TAR to be produced at the works for One, Two, or Three years, from the 1st day of July next. Coals carbonized from 3000 to 4000 tons per annum.

Sealed tenders, addressed to the Chairman, to be sent not later than the 21st inst.

The Directors do not bind themselves to accept the highest or any tender.

Gas Office, Ossett, June 1, 1876.

LEIGH GAS-WORKS, LEIGH, LANCASHIRE.

TO GASHOLDER MAKERS AND OTHERS.

THE Gas Committee of the Leigh Local Board are prepared to receive TENDERS for the supplying, erection, and completion of a single-lift GASHOLDER, 100 ft. diameter and 28 ft. deep.

Drawings and specification may be seen on application to the Engineer, at the works, Gas Street, Leigh.

Sealed tenders to be sent in on or before Monday, June 19, 1876, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Gasholder."

The Committee do not bind themselves to accept the lowest or any tender.

Further particulars may be obtained from the Engineer.

By order,
JOSEPH TIMMINS, Engineer and Manager.

Just published, price 10s. 6d.,

REGISTRATION OF DISTRIBUTORY PLANT.

The forms for this purpose are to illustrate the Paper on Distribution of Gas, read at the Edinburgh Meeting of the British Association of Gas Managers. By the use of the synopsis the whole of the out-door plant may at once be seen, with all matters pertaining to the same.

W. J. WARNER, Engineer.

South Shields.

TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT, having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.

Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.

Patents procured for Foreign Countries.

Information as to cost, &c., supplied gratuitously upon application to the Advertiser, 22, Great George Street WESTMINSTER.

BRITISH
ASSOCIATION OF GAS MANAGERS.

ANNUAL MEETING OF MEMBERS

CIRCULAR OF ARRANGEMENTS.

THE

THIRTEENTH ANNUAL GENERAL MEETING

OF THE MEMBERS OF THIS ASSOCIATION WILL BE HELD ON

TUESDAY, WEDNESDAY, & THURSDAY, the 13th, 14th, & 15th of June, 1876,

AT THE

SOCIETY OF ARTS ROOMS, JOHN STREET, ADELPHI, LONDON.

ROBERT MORTON, ESQ., M. INST. C.E., PRESIDENT,

Will occupy the Chair.

ORDER OF PROCEEDINGS.

TUESDAY, JUNE 13, 1876.—Morning Meeting.

The Chair to be taken at Eleven o'clock.

Inaugural Address by the President. | Admission of New Members.
Reading of Papers and Communications.

Evening Meeting.

A Lecture will be delivered at the Society of Arts Rooms, by W. MATTHIEU WILLIAMS, Esq., F.R.A.S., F.C.S., &c., &c., On "The Different Qualities of Iron and Steel, their Manufacture and Applications."

The Chair will be taken at Half-past Seven o'clock.

WEDNESDAY, JUNE 14, 1876.

The Chair to be taken at Eleven a.m.

Reading of Papers and Communications, and the Transaction of other Business.
Election of Officers for ensuing Year, &c.

At Six p.m. the Members and Friends will dine together at the Terminus Hotel, Cannon Street. Tickets for the Dinner, 7s. 6d. each, may be had from the Secretary, if taken on or before the 13th of June. After that date 10s. will be charged.

THURSDAY, JUNE 15, 1876.

An Excursion by Steamboat to Beckton, where, by the courtesy of the Chartered Gas Company, the Members will have the opportunity of inspecting the Gas-Works, which have, since their last visit, undergone enormous extensions, and are now by far the largest Gas-Works in the world. On finishing the inspection the Members will re-embark, when Luncheon will be served, and the Boat continue its course down the river as far as time will permit of its return to London by about Six o'clock p.m.

LIST OF PAPERS AND COMMUNICATIONS

TO BE SUBMITTED TO THE MEETING.

SUBJECT FOR DISCUSSION—"THE ESTABLISHMENT OF A BENEVOLENT FUND."

The Order in which the Papers are Read will be determined by the Committee prior to the Meeting, so as to suit the general convenience.

"Piece Work or Day Work, as applied to the Reduction of the Labouring Force in Gas-Works." By Mr. T. TRAVERS, of Cork.
"Is the Reduction of the Sulphur Compounds worth the Cost and Trouble it entails." By Mr. GEO. LIVESEY, of London.
"The Reduction of Sunday Labour." By Mr. CORBET WOODALL, of London.
"Heating Retorts." By Mr. WM. RICHARDS, of London.
"Further Experience with Concrete Tanks." By Mr. GEO. LIVESEY, of London.
"Mains and Services." By Mr. W. J. WARNER, of South Shields.
"The Best Means of Extending the Use of Gas." By Mr. JAS. WATSON, of London.
"Is the Removal of the Dip desirable?" By Mr. W. L. COPP, of Watchet.
"Valuation of Ammoniacal Liquor." By Mr. W. D. CHILD, of London.
"A New Self-Regulating Exhausting Apparatus." By Mr. F. W. FISON, of Ilkley.
"The Comparative Working Results of West's Mechanical Stoker." By Mr. R. P. SPICE, of London.
"Washers or Scrubbers." By Mr. C. HUNT, of Birmingham.

May 27, 1876. WILLIAM H. BENNETT, *Secretary.*

Now Ready, price 10s. 6d.,

AN ANALYSIS OF THE METROPOLITAN GAS COMPANIES ACCOUNTS FOR 1875,

(In continuation of the previous Six Years, 1869—1874,)

COMPILED AND ARRANGED BY JOHN FIELD,

LATE CHIEF ACCOUNTANT TO THE IMPERIAL GAS COMPANY.

And by the same Author,

A COMPARATIVE AVERAGE ACCOUNT BOOK

FOR THE ENTRY OF GAS COMPANIES ACCOUNTS FOR SERIES OF YEARS.

Price, for Half Yearly and Yearly Comparison, Foolscap Size, for 20 Years, 21s.; Quarto, for 14 Years, 12s. 6d.; for Yearly Comparisons only, for 14 Years, 8s. 6d.

Can be had of WM. B. KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

AND OF

EDEN FISHER, STATIONER, 50, LOMBARD STREET, LONDON, E.C.

Thicker Books for several Companies Accounts by order to E. FISHER.

SPILSBY GAS COMPANY.

TENDERS FOR COALS.

WANTED, 100 tons of Strafford, Clarke's, Cooper's Best, or Newton Chambers and Co.'s Unscreened Silkstone COALS, and 300 tons of similar SMUDGE (21 cwt. to the ton), to be delivered, carriage free, at Spilsby Station, in equal proportions, during the months of July, August, and September next.

Tenders to be sent to me on or before the 16th inst.

The Directors do not bind themselves to accept the lowest or any tender.

THOS. THIMBLEBY, Secretary to the Gas Company.

Spilsby, June 1, 1876.

TO COLLIERY PROPRIETORS.

THE Directors of the Aylesbury Gaslight and Coke Company are open to receive TENDERS for the supply of 2000 tons of either of the undermentioned kinds of GAS COAL, to be delivered at the London and North-Western Railway Station, Aylesbury, in such monthly quantities as shall be determined, commencing the 1st of July next, viz.:—

Best screened Newcastle Coal, New Pelton, Pelaw Main, Ravensworth Pelaw, or Holmside; best screened Yorkshire or Derbyshire Silkstone; best screened Lancashire-Wigan Arley Mine; or best screened Staffordshire Gas Coal.

Each tender to specify the pits at which the Coal tendered for is raised, and to be accompanied by an analysis, showing the results in regular working, in accordance with which the Contractor will be bound to supply the Coal.

The Coal is to be fresh from the pits, well screened, of the best quality, and free from bind, pyrites, and all impurities; to be 20 cwt. to the ton, registered over the London and North-Western Railway Company's machine, Aylesbury, and paid for accordingly.

Sealed tenders, to be sent in on or before the 14th inst., addressed to the Chairman, and marked "Tender for Coal."

The Directors do not bind themselves to accept the lowest or any tender.

By order,
WILLIAM PARLBY, Engineer and Manager.

Gas-Works, Aylesbury, June 2, 1876.

CONTRACT FOR COAL, &c.

THE Directors of the Preston Gas Company are prepared to receive TENDERS for the supply of CANNEL, COAL, and Cannel Slack or Nuts, for the next One, Three, or Five years.

Tenders, endorsed "Tender for Coal, &c." and addressed to the Chairman of the Committee, must be delivered on or before Saturday, the 10th of June next.

Further particulars may be obtained from HENRY GREEN, Engineer.

Gas-Works, Preston, May 12, 1876.

CHELTENHAM GASLIGHT & COKE COMPANY.

TENDERS FOR GAS COAL AND CANNEL.

THE Directors of the Cheltenham Gaslight and Coke Company invite TENDERS for the supply of the best quality of GAS COAL and CANNEL, for the year commencing the 1st of July next.

For quantities and conditions of contract, application to be made to the Company's Engineer.

Sealed tenders, addressed to the Engineer, must be forwarded on or before Thursday, the 22nd proximo.

The Directors do not bind themselves to accept the lowest or any tender.

R. O. PATERSON, Engineer.

Gas-Works, Cheltenham, May 29, 1876.

HALIFAX CORPORATION GAS-WORKS.

CONTRACTS FOR COAL.

THE Gas Committee are prepared to receive TENDERS for the supply of 3000 tons of CANNEL, and 16,000 tons of best GAS COAL.

Further particulars, and printed forms of tender, may be obtained on application to Mr. W. Carr, Manager of the Gas-Works.

All tenders, endorsed "Tender for Coal," must be sent to me on or before Thursday, the 15th inst.

By order,
A. C. FOSTER, Town-Clerk.

Town-Hall, Halifax, June 3, 1876.

Now ready, Second Edition, price 7s., by post 7s. 3d., the

GAS MANAGER'S HANDBOOK.

By THOMAS NEWBIGGING, A.I.C.E.

The scope of this work is apparent from its title. The First Edition, published a few years ago, was eagerly sought for, and has been now for some time out of print. The favourable reception accorded to it sufficiently proved that it supplied a generally acknowledged want in the profession. The work has undergone careful revision; much new matter has been added; and the New Edition is published in fcap. 8vo., morocco, gilt.

Orders to be sent to the Publisher,

WILLIAM B. KING,
11, BOLT COURT, FLEET STREET, LONDON, E.C.

JOHN HALL AND CO., STOURBRIDGE,

Manufacturers of FIRE-BRICKS, LUMPS, TILES,

AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.

N.B.—A Stock of 15 and 16 in. CIRCULAR RETORTS always on hand. Other kinds made to order on short Notice.

ALFRED WILLIAMS,

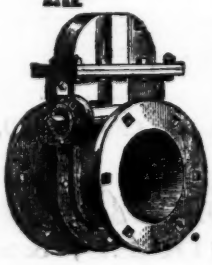
PHŒNIX FIRE-BRICK WHARF,

64, BANKSIDE, SOUTHWARK, LONDON, S.E.

GAS ENGINEER AND CONTRACTOR FOR THE ERECTION OF GAS-WORKS,
AND FOR THE
SUPPLY OF RETORTS, FIRE-BRICKS, CAST-IRON MAINS,
AND ALL MATERIALS FOR GAS MANUFACTURE AND DISTRIBUTION.

B. DONKIN & CO.'S
IMPROVED GAS-VALVES

WITH WROUGHT-IRON PINIONS,



List of prices, with full dimensions of all sizes up to 48-inch, to be had on application.

These Valves are all proved on both sides to 30 lbs. on the square inch before leaving the works, and are always kept in stock.

VALVES MADE WITH OUTSIDE RACKS TO ORDER.
ALSO, SCREW WATER-VALVES WITH GUN-METAL FACES.
ALSO SOLE MAKERS OF
J. BEALE'S NEW PATENT GAS EXHAUSTERS.

B. DONKIN & CO.,
GENERAL ENGINEERS AND IRONFOUNDERS,
MAKERS OF STEAM-ENGINES,
55a, BLUE ANCHOR ROAD, BERMONDSEY,
LONDON, S.E.

IMPERIAL CONTINENTAL GAS ASSOCIATION.

(INCORPORATED BY ACT OF PARLIAMENT.)

The HALF-YEARLY ORDINARY MEETING of the Imperial Continental Gas Association was held at the City Terminus Hotel, Cannon Street, London, on TUESDAY, the 30th inst.

PHILIP TWELLS, Esq., M.P., the Chairman, when the following Resolutions were passed:—

Resolved unanimously — "That the report upon the affairs of the Association now read be received, adopted, and entered on the minutes."

Resolved unanimously—"That a dividend of £2 per share, and a bonus of 15s. per share, be declared upon the 56,000 shares of the Association, for the half year ended the 31st of December last; and that the said dividend be payable, free of income-tax, on and after the 15th of June next."

Resolved unanimously—

"That James Helme, Esq., be re-elected a Director of the Association."

"That Henry Wood, Esq., be re-elected a Director of the Association."

"That John Horsley Palmer, Esq., be re-elected a Director of the Association."

"That Thomas Newton Stokes, Esq., be re-elected an Auditor of the Association."

"That the cordial thanks of the meeting be given to the President and Directors for their able management of the affairs of the Association, and to the Chairman for his conduct in the chair this day."

Upon the motion of the Chairman, Mr. Philip Twells, a vote of thanks was also given to Mr. G. W. Drory, the General Superintendent of the affairs of the Association on the Continent, and to the Agents, Engineers, and other Officers of the Association.

By order of the Board of Direction,
ALBERT F. JACKSON, Secretary.

30, Clement's Lane, Lombard Street, London,
May 31, 1876.

PETERBOROUGH GAS COMPANY.

TENDERS FOR COAL.

THE Directors of this Company are prepared to receive TENDERS for the supply of about 4000 tons of the Best Screened GAS COAL, delivered free at the Great Northern Coal Department, Peterborough, in such quantities monthly as may be required between the 1st day of July, 1876, and the 30th day of June, 1877; or, at the option of the Directors, for 8000 tons, to be delivered as aforesaid between the first mentioned date and the 31st day of March, 1878.

Tenders, giving particulars of the Coal, and stating the name and locality of the pit, and the seam from which the Coal is to be taken, must be delivered to me on or before the 17th day of June next.

The Directors do not bind themselves to accept the lowest or any tender. Payments monthly.

By order,
WILLIAM J. MOON, Manager.

Gas-Works, Peterborough, May 25, 1876.

PETERBOROUGH GAS COMPANY.

TAR AND LIQUOR CONTRACT.

THE Directors of this Company are prepared to receive TENDERS for the surplus TAR and the whole of the AMMONIACAL LIQUOR produced at their works, for a period of One or Two years, from the 1st day of July next.

The Gas Company will deliver the Tar and Liquor respectively into railway tank trucks, at the Goods Department of the Great Northern Railway at Peterborough.

Further information may be obtained on application to me, to whom tenders, stating the price per ton, and whether the offer is for one or two years, must be sent not later than the 17th day of June next.

The Directors do not bind themselves to accept the highest or any tender.

By order,
WILLIAM J. MOON, Manager.

Gas-Works, Peterborough, May 25, 1876.

WIGAN BOROUGH GAS-WORKS.

TO COLLIERY PROPRIETORS IN THE WIGAN DISTRICT.

THE Gas Committee of the Corporation are prepared to receive TENDERS for the supply of 15,000 tons of best screened GAS COAL delivered at the Wigan Gas-Works.

Parties tendering to state class of coal and size of screen over which the coal is passed.

The deliveries to commence on the 1st of July next, in the quantities and at the times as required by the Manager of the Gas-Works; and the Committee reserve to themselves the right to determine the contract without notice, if at any time the delivery be inferior to the quality contracted for.

Tenders to be sent in to Mr. J. G. Hawkins, Gas Manager, Wigan, on or before the 13th of June, 1876, marked "Tender for Gas Coal."

The Committee do not bind themselves to accept the lowest or any tender.

MASKELL WM. PEACE, Town-Clerk.

June 1, 1876.

ROCHDALE CORPORATION—GAS DEPARTMENT.

TENDERS FOR COAL AND CANNEL.

THE Gas Committee of the Corporation are prepared to receive TENDERS for the supply of COAL and CANNEL during a period of One, Two, or Three years, to be delivered free at the Milkstone siding, Rochdale, or at the Gas-Works, in the following quantities each year, and in such monthly proportion as the Engineer may direct, viz.:—

Year ending		
June 30, 1877	Coal	16,500 tons.
	Cannel	4,500 ,,
June 30, 1878	Coal	18,000 ,,
	Cannel	12 000 ,,
June 30, 1879	Coal	20,000 ,,
	Cannel	13,000 ,,

Tenders, endorsed "Tender for Coal," to be sent to me on or before the 20th of June, 1876.

Further particulars may be obtained from Mr. Paterson, Gas-Works, Rochdale.

By order,
ZACH. MELLOR, Town-Clerk.

Town-Hall, Rochdale, May 26, 1876.

T. NEWBIGGING,

CONSULTING GAS ENGINEER,

5, NORFOLK STREET, MANCHESTER.

Mr. ALFRED LASS,

60, CORNHILL, LONDON, E.C.,

Is prepared to open the Books, and, if necessary, keep the Accounts of Gas and Water Companies.

To examine the Books and Accounts, and prepare Balance-Sheets for the information of Directors.

To assist Secretaries in preparing Balance-Sheets, according to the "Gas-Works Clauses Act, 1871;" or may be consulted with respect to Accounts generally.

D. M. NELSON,

48, GORDON STREET (late 135, BUCHANAN ST.),

GLASGOW,

Supplies every requisite in connexion with the distribution of Gas and Water.

Estimates and prices on application.

WOOD GRIDS for Purifiers and Scrubbers.

Cast-Iron PIPES and VALVES.

Street LAMP-PILLARS.

Patent Pipe SCREWING-MACHINES, &c.

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Manufacturers of all kinds of Indexes for Gas and Liquid Meters, Tell-Tales for Turnstiles, on an improved principle. Every description of Wheel and Worm Cutting any size, &c.

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Manufactory for every description of Casting and Machinery for Gas-Works and Water-Works.

Warehouse in London for Cast-Iron Pipes and Connexions of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.

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For Repairing Gas-Retorts in Action, preventing Porosity, and reducing the Deposit of Carbon, is highly commended.

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Keep in London and at their works large stocks of PIPES and CONNEXIONS (1½ to 36 inches in diameter); also make and supply Retorts, Tanks, Columns, Girders, Special Castings required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

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Castings for Gas-Works of every description.

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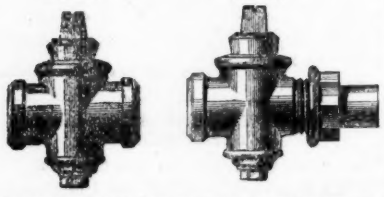
CAST-IRON GAS-MAIN COCKS,

WITH PATENT WHITE METAL PLUGS.

TRADE (L) MARK.

No. 758. No. 759.



The bodies of these Taps are made of iron, black or galvanized, and the plugs of patent metal. They are warranted not to set fast or corrode, as do Iron or Brass Cocks: will always work easily; are strong, well made, durable; of little or no intrinsic value, and therefore not likely to be stolen; and the prices as stated below are (especially upon the larger sizes) fully 50 per cent. less than Brass Cocks.

	½	¾	1	1¼	1½	2-inch.
No. 758, with inside screws for iron pipe, black	2/0	3/0	4/4	6/6	7/6	12/0 each.
No. 759, with union on one end screwed inside for iron pipe, black	2/9	3/10	5/4	8/0	9/0	15/6 each.
Nos. 758 and 759, galvanized	0/3	0/4	0/6	0/8	0/10	1/4 extra.

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(Successors to LYNCH WHITE,)

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CAST-IRON RETORTS, SOCKET-PIPES for GAS or WATER PURPOSES, FLANGE-PIPES for STEAM, RAIN-WATER PIPES and GUTTERS, HOT-WATER PIPES and BOILERS, and all requisite Connexions for same; also LAMP-COLUMNS, LAMPS, WROUGHT FRAMES, WROUGHT-IRON TUBING, &c., &c.

All kinds of Gas-Works Apparatus and General Castings made to Pattern or Drawing.

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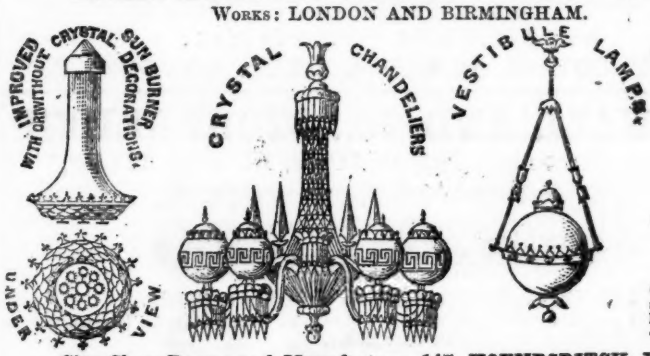

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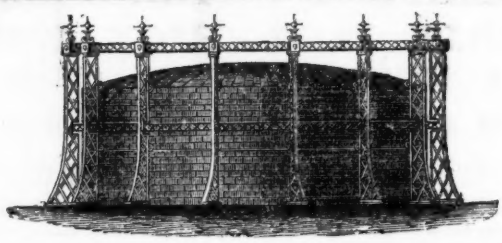

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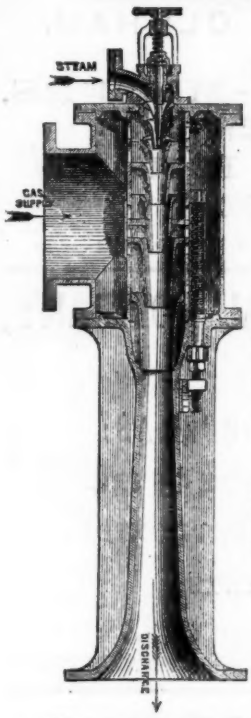

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Small Cost—Compactness—Perfectly Self-Acting—Self-Regulating—Self-Cleansing—No Steam-Engine—No Attention—No Extra Room Required—No Wear and Tear—No Noise—No Oscillation in Vacuum, or Back Pressure.

UPWARDS OF 200 IN USE.

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Combining small cost and thorough efficiency, with absence of any mechanical means and necessity of renewing the scrubbing material.

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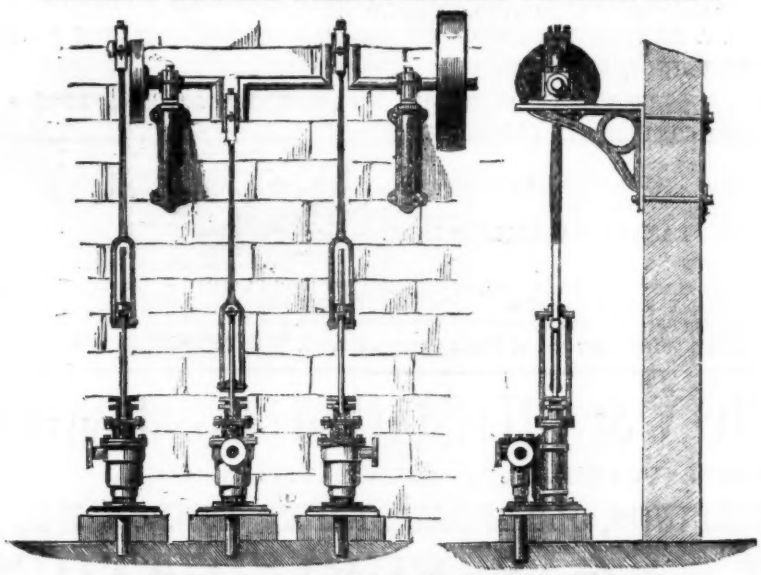

IMPROVED DOUBLE-ACTION PUMPS.
For Water. For Tar. For Ammoniacal Liquor.

This illustration shows an arrangement of three (No. 179) Improved Double-Action Pumps driven from the same crank-shaft, as frequently supplied for use in Gas and Chemical Works. The suction and discharge pipes can be arranged for drawing from and delivering in any required direction.

These Pumps have been supplied to nearly all the large Gas Companies and Chemical Works, both for Pumping Water, Tar, and Ammoniacal Liquor.

GAS SYPHON PUMPS, IN COPPER OR SHEET IRON, ALWAYS IN STOCK.

Illustrated Catalogues sent post free on application.

CATHELS'S Patent District Dry Gas-GOVERNOR is the only perfect self-acting contrivance for Regulating the Pressures in the higher levels of a district.

For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHRIMES, ROTHERHAM.

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SZERELMEY IRON PAINT having been in use for upwards of twenty years, has stood the test of time. SIR CHARLES BARRY reported to the Chief Commissioner of Works (in 1859) that the Iron Roofs of the Westminster Palace, coated in 1856, "Still afford the most convincing and satisfactory evidence of its efficacy," and anyone who looks at the work now, in 1876, will see the same evidence.

THE Undersigned have, by means of extensive machinery and improved processes, succeeded in reducing the price of the Szerelmey Iron Paint, that which was formerly sold at £55 they now supply at £33, and make other kinds, commencing at £20 per ton, including Black, Purple, Chocolate, Red, Green, Blue, Bronze Green, Grey, White, and various tints.

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SZERELMEY Stone Paint thoroughly waterproofs brick and other walls without giving them the appearance of having been painted.

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These Paints have been for many years extensively used in Her Majesty's Royal Dockyards, Woolwich Arsenal, the Shorncliffe and Curragh Camps, War Departments, and Colonies, and are largely supplied to Railway, Harbour, and GAS COMPANIES, Shipowners, Engineering Establishments, Railway Carriage and Waggon Works, and the Paint Trade generally. They are the BEST PROTECTORS of IRONWORK, even arresting corrosion after it has set in; and their base being oxide of iron, they are free from those properties which make lead paints so destructive to ironwork. They do not scale or blister, are not affected by great heat, and are the only Paints which will resist the effects of sulphuretted hydrogen. Their DURABILITY and covering properties have borne the test of A QUARTER OF A CENTURY'S PRACTICAL TRIAL.

The undermentioned colours—ground in best linseed oil, and requiring only before use to be thinned down in the ordinary way—are kept in stock:—

Torbay Brown.	Torbay Red.
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All other Colours made to order.

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CLOTH GAS-BAGS FOR MAINS,

As supplied to the Imperial, Chartered, and other London and Provincial Gas Companies. Bellows and Valves for inflating Well Dresses, Stokers Gloves, India-Rubber Suction and Delivery Hose, Gas-Tubing, Leather India-Rubber and Gutta-Percha Machine-Bands, Sheet and Washers and Steam Joints.

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Requiring New Street-Lamps are recommended
A **KEEN'S PATENT DOUBLE-CLIP STREET-LAMP.**
A great improvement on the old-fashioned 14-in. Lamps.
They have been sold to various Gas-Works throughout the country and abroad, and
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Beg to intimate to Gas Companies and others that they are now prepared to supply these very superior Meters at the same prices as for the ordinary Gas-Meters.

In the construction of this Meter, for which the best tin plates only are used, every mechanical contrivance has been taken advantage of successfully to reduce the friction to a minimum, which is amply proved by the fact that they are made to work upon only one-fortieth of an inch pressure. By an improvement also in their construction, a steadier light is obtained, and greater capacity than can be got from any other Meter in the market. No gas can pass under the valves on any back pressure, as is the case with many other Dry Meters.

To Gas Companies supplying gas through streets with heavy gradients, these Meters are invaluable, as much gas is saved from the low pressure required to work them.

ALL METERS ARE UPHELD FOR FIVE YEARS.

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ENGINEERS, GOVERNMENT CONTRACTORS, & MANUFACTURERS OF GALVANIZED CORRUGATED IRON ROOFS, BUILDINGS, AND SHEDDING,
For which Estimates will be given on application,
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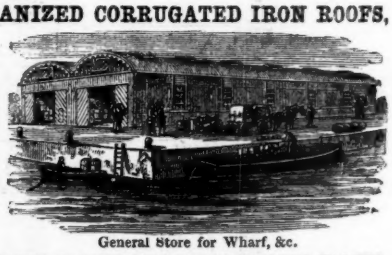
PREPARED TO PLAN FOR ERECTION ABROAD,
EITHER WITH
TIMBER FRAMING or WHOLLY in IRON.

Open Shed for Covering Large Areas.



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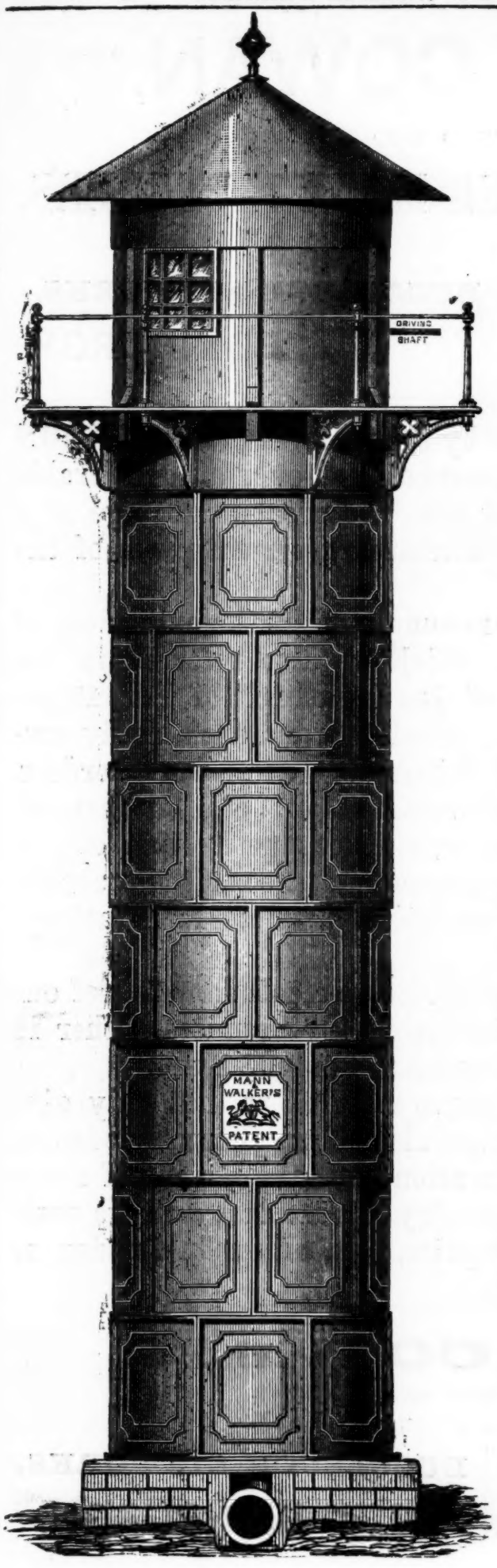
The superiority of the material supplied by this Company is generally recognized, and it is now in use in nearly all the London and most of the large Provincial Gas-Works.

JOHN WILLIAM O'NEILL, SAMUEL H. JOHNSON, } Joint Managing Directors.



C. & W. WALKER,
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MANN & WALKERS' PATENT SCRUBBER.

By Letters Patent in Great Britain, Europe, and the United States of America.

By some important improvements recently patented, the purifying power of these Scrubbers has been much increased, and a stronger ammoniacal solution obtained, which is found to absorb a large portion of the carbonic acid contained in gas, effecting an important saving in money and labour in the lime purifiers, and where oxide only is used, the increase in the illuminating power of the gas obtained by these Scrubbers is shown in a remarkable degree, in consequence of the large quantity of carbonic acid removed from the gas.

It is to be particularly noted that the important results of these Scrubbers do not depend upon the machinery alone. The entire internal construction of the Scrubber bears an almost equally important part. For this reason, where it is desirable to convert existing Scrubbers, whose dimensions happen to be suitable, the work commences by ripping out the whole of the interior of the shell, and beginning the internal construction *de novo* from bottom to top.

They are, in all cases, constructed under guarantees to perfectly perform their work. They are now extensively used in the largest gas-works of London and the chief cities of Europe, the number in use exceeds **one hundred,** and their perfect efficiency and profit to a gas company have been fully established with every variety of coal used in Europe. References can be given to the largest gas-works in Europe.

By their use the department of purification from ammonia upon a gas-works is made complete, without the aid of prepared oxide of iron, chemicals in purifiers, or any other supplementary process, and the whole ammoniacal residual product contained in the coal is absorbed and obtained in the form most profitable to a gas company, while the requirements of all Acts of Parliament and of the Board of Trade, relating to incorporate gas companies, are satisfied.

Foul Gas, properly condensed, entering the inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machinery room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals, generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

They contain their own engine power, requiring only a small inappreciable quantity of steam from the gas-works boiler, and are then complete in themselves, ready for service.

Applications relating to dimensions and prices should be addressed to us, C. AND W. WALKER, 8, FINSBURY CIRCUS, LONDON, E.C., or to Mr. WILLIAM MANN, late Superintendent of the Chartered Gas-Works, BLACKFRIARS, LONDON; they should state approximately the largest make of gas in 24 hours on a winter's day, and the smallest make on a summer's day, to be purified.

W. & B. COWAN,

(ESTABLISHED 1827,)

WET & DRY GAS-METER MANUFACTURERS,

CHURCH STREET,
MILLBANK STREET,
(NEAR THE HOUSES OF PARLIAMENT.) **LONDON, S.W.**

BUCCLEUCH ST. WORKS,
EDINBURGH.

As already intimated, we have, by the removal of our LONDON WORKS to the above address, secured not only a considerable extension of accommodation, but also the great advantage of a central position, and one easily accessible from all parts of the Metropolis.

We have now the pleasure of announcing that the extensions of our EDINBURGH WORKS, to which we also referred in our advertisement in the "Journal of Gas Lighting" of Feb. 15 (as being then in contemplation), are completed, and are already contributing to the more speedy and satisfactory execution of orders.

The additions to, and improvements of, our mechanical appliances for the accurate and expeditious production of the various parts of both wet and dry gas-meters, are such as probably do not exist, to the same extent, in any other gas-meter manufactory, either in this country or abroad.

It will afford us much pleasure to receive a call from any of our friends who may be interested in seeing our premises, either in London or Edinburgh, and the processes of manufacture.

The additions to our works, above referred to, not only give increased means of manufacture, but also enlarged accommodation and facilities for the repair, alteration, and adjustment of every description, and make, of wet and dry gas-meters; and we shall be glad to receive meters for repairs, &c., either in London or Edinburgh.

W. & B. COWAN,

(ESTABLISHED 1827,)

CHURCH STREET,
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(NEAR THE HOUSES OF PARLIAMENT.) **LONDON, S.W.**

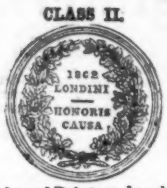
BUCCLEUCH ST. WORKS,
EDINBURGH.

PATENT ANTIMONY PAINT.

MADE ONLY BY

GEORGE HALLETT & CO.,

296, ROTHERHITHE, LONDON, S.E.



This Paint having been in general use over fourteen years (especially in some of the principal Gas-Works), and proved itself the best light-coloured Paint produced for resisting the influence of vitiated atmospheres, it is important that its qualities should be more widely known.

It is not discoloured like white lead in a sulphuretted atmosphere, nor washed off like white zinc; and its light colour reflecting heat, produces much less expansion of gas in holders painted with it than with dark colours, besides rendering them much more sightly. Its specific gravity is so much below white lead that the same weight will cover one-third more surface, while it is equal in body; and its price being about the same (30s. per cwt.), it is actually one-third cheaper. From experience, its manufacture is greatly improved, and it is quite suitable for all purposes in which white lead is employed.

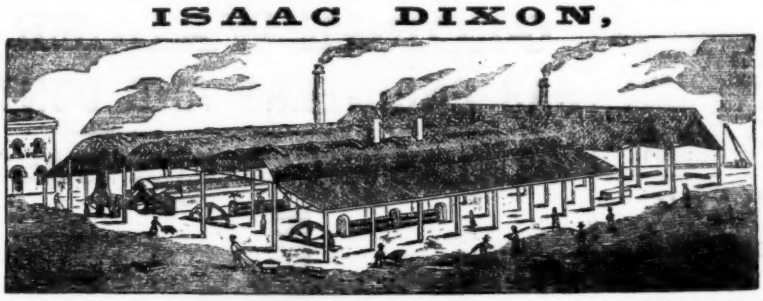
The following Gas Companies in London have used the Paint for years—viz., The Gaslight and Coke, Imperial, Independent, City of London, Commercial, London, and Surrey Consumers.

N.B.—Antimony Paint, COVERING SO MUCH MORE WORK, costs about 20s. per cwt., as compared with White Lead at 30s. per cwt.; a similar economy arises from its use in Steam and Gas Joints, for which purpose it is superior to White Lead.

SPECIAL DRIERS FOR ANTIMONY PAINT SUPPLIED.

ISAAC DIXON,

WINDSOR IRON-WORKS, LIVERPOOL.



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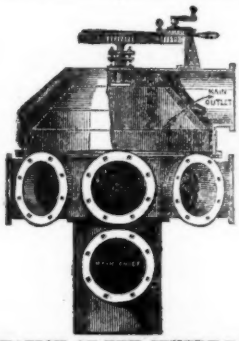
Manufacturer of SELF-SUPPORTING GALVANIZED CORRUGATED, CURVED, and every kind of IRON ROOFING, CHURCHES, SCHOOLS, SHEDS, and IRON BUILDINGS.

WROUGHT and CAST IRON GIRDERS, BRIDGES, TANKS, &c., and all kinds of WIRE WORK, FENCING, GATES, HURDLES, &c., for Home or Abroad.

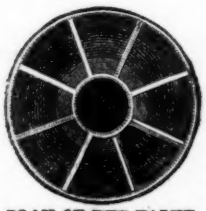
DIXON'S CELEBRATED SELF-SUPPORTING IRON ROOFS are specially suitable for Forges, Rolling-Mills, Iron-Works, Shipbuilding Yards, Mines, Collieries, Gas and Water Works, and for general purposes.

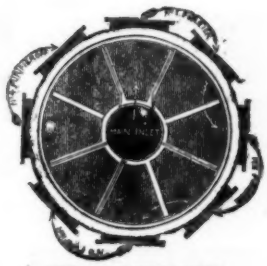
For Roofs with Timber Framing, DIXON'S GALVANIZED OR TARRED IRON SLATES form a durable and cheap covering, costing only about the same, when fixed, as felt and boards.

DRAWINGS, ESTIMATES, AND ILLUSTRATED CATALOGUES MAY BE OBTAINED ON APPLICATION.



C. & W. WALKERS' PATENT CENTRE-VALVES.





ELEVATION OF THE CENTRE-VALVE. **PLAN OF THE VALVE.** **PLAN OF THE BODY.**

These PATENT CENTRE-VALVES are the most perfect and certain means for working Purifiers on the system of three in action, and one out of action. The Valve itself is protected from all injury inside the safety cover. The working of the Valve is so easy, and so governed by the stop-catch movement, that the Purifiers can be instantaneously changed in the dark as well as in daylight. They are scraped perfectly true, metal to metal, the facings heretofore exposed are always covered, and there is nothing more reliable, certain, and durable in a gas-works. By their use the floor of the Purifying-house is clear and level; the Valve and all connexions being beneath the floor, out of the way of working. A considerable improvement and saving is effected in the cost of the connecting-pipes.

MIDLAND IRON-WORKS, DONNINGTON, near NEWPORT, SHROPSHIRE; 8, FINSBURY CIRCUS, LONDON.

Established

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THE ORIGINAL

WORTLEY FIRE-BRICK WORKS,

NEAR LEEDS,

MANUFACTURERS OF ALL DESCRIPTIONS OF

FIRE GOODS, and Salt-Glazed Drain-Pipes.

LONDON WHARF:

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Where is always kept a Stock of Retorts, Fire-Bricks, Terra Cotta Ware, and Drain-Pipes.

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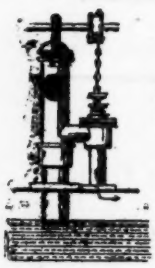
COPP'S PATENT ANTI-DIP GAS APPARATUS.



Produces from 10 to 20 per cent. more gas of higher illuminating power.
Prevents the deposit of carbon.
Retorts last much longer.
Charges work off quicker.
This simple invention has been in use in many works for the last six months, with the above results.

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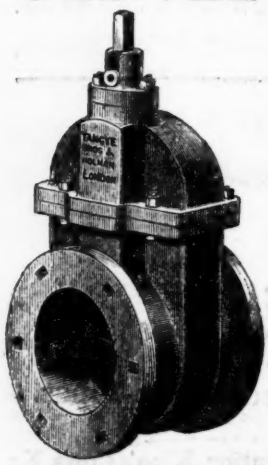

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REFERENCES TO 500 WORKS ALREADY ERECTED.

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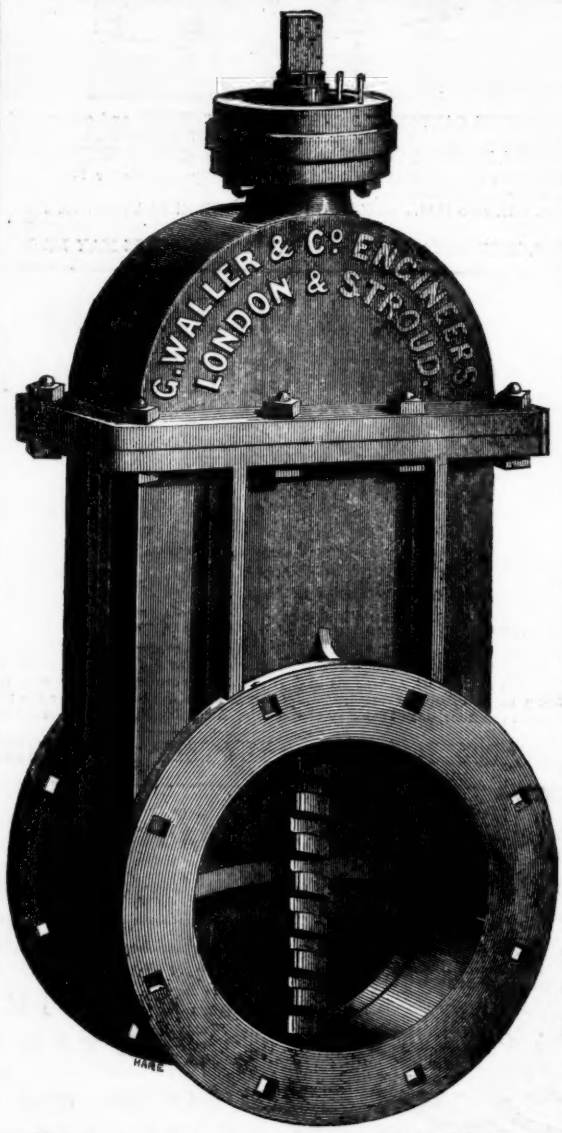
GAS ENGINEERS AND CONTRACTORS.

IMPROVED INDEX GAS-VALVE.



The Door of Valve has a Circular Wedged Back.

G. WALLER & CO.

Were the first manufacturers of Gas-Valves with Circular Wedged Backs.

The springs are to clear off any dirt from the face of door when closing. **The body is cast in one piece.**

These Valves are proved on both sides to 30 lbs. per square inch. The worm keeps the door open at any point, and clears out any dirt in the rack. One man can open the largest Valve without extra gearing. The Index on top has large studs to show how much the Valve is open, and they can be **readily felt in the dark.**

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ROUND STATION-METERS,

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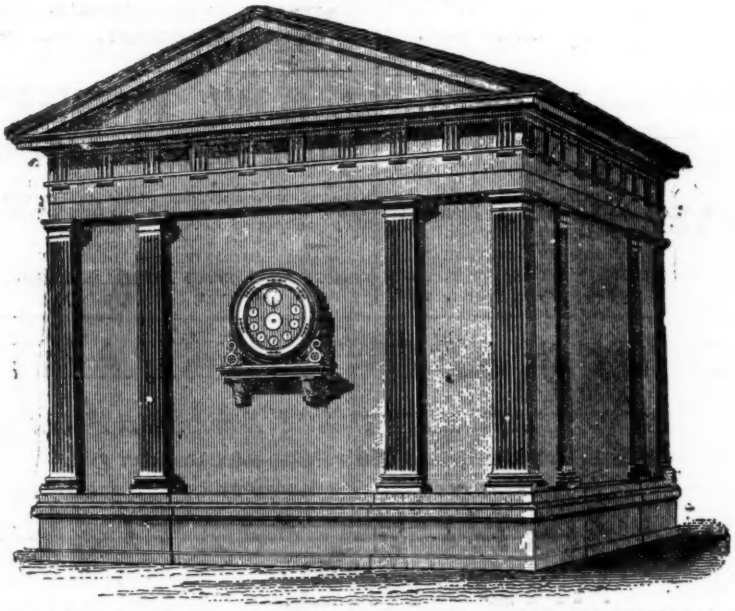

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WITH PLANED JOINTS.

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TABLE GLASS OF ALL KINDS.

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N.B.—Pamphlet, with Eighteen Illustrations of the foregoing, with letterpress on the construction of Gas-Works, post free, 2s. 6d.

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COTTERILL'S PATENT STEEL TUBE-DRILLS, for connecting services to water-mains, *under pressure*, without turning off the water. They drill and tap themselves, and are left in the mains. Made of all sizes, from ¾ to 2 inches and upwards. They cost less than the ordinary plan.

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Manufacturers of GAS-RETORTS, GLASS-HOUSE FURNACE & BLAST-FURNACE BRICKS LUMPS, TILES, and every description of FIRE-BRICK.

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BEST GLASS-HOUSE POT and CRUCIBLE CLAYS.

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THE ORIGINAL MANUFACTURER OF

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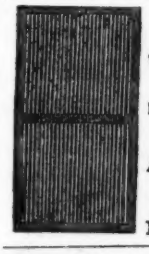

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PREVENTS WASTE OF GAS FROM RETORTS;

SAVES CLAY RETORTS FROM DESTRUCTION BY FIRE;

GREATLY ECONOMIZES THE USE OF FIRE-BRICKS;

And PREVENTS ALL POSSIBLE LOSS of GAS FROM LEAKAGE.

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18 & 20, ALSTON STREET, GLASGOW.

CAST-IRON GAS AND WATER PIPES.

DELIVERY F.O.B. ON CLYDE, OR STOCKTON-ON-TEES.

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The NEW PATTERN

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LOTHIAN'S CANNEL
Yields 12,500 cubic feet of 34-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

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Are prepared to supply their
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This Coal yields 11,000 cubic feet of gas and 13½ cwts. of coke per ton.
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Cubic feet of Gas yielded per ton . . .	10,050
Illuminating power in sperm candles . .	15·4
Yield of coke per ton of good quality . .	13¾ cwts.

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POPE & PEARSON, LIMITED, have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.
One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.
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The Subscriber is prepared to contract for the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.
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Established 1840.

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And Every Description of Best Fire-Bricks.

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Beg leave to call the attention of Gas Companies to the superior quality of their
CANNEL FOR GAS-MAKING PURPOSES.
This Cannel produces in actual working, in iron retorts, 9200 cubic feet of 32-candle gas, and upwards of 11 cwt. of coke, and in clay retorts will produce 11,500 cubic feet of 25·9-candle gas.
Ports of shipment—Birkenhead or Connah's Quay.
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Supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, &c.
N.B.—The Wigan Coal and Iron Company, Limited, are exclusive owners of the well-known HAIGH HALL AND KIRKLESS HALL GAS COAL COLLIERIES.

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GAS COAL & CANNEL.

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Has on hand a quantity ready for immediate delivery, and is prepared to contract for Supplies during the years 1876 and 1877.
Can strongly recommend his real OLD SILKSTONE GAS COAL, which will give, in regular work, 10,200 feet 16·6-candle gas, and 12 cwt. superior coke.
PRICES AND ANALYSIS WILL BE FORWARDED TO ANY PART ON APPLICATION TO THE CHIEF OFFICE,
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MESSRS. NEWTON, CHAMBERS, & CO.,
THORNCLIFFE IRON-WORKS AND COLLIERIES,
NEAR SHEFFIELD,
STRONGLY RECOMMEND A TRIAL OF THEIR
CELEBRATED SILKSTONE GAS NUTS.
Analysis by F. J. EVANS, Esq., Chartered Gas Company, Horseferry Road, Westminster:—
(COPY.)

	Cubic Feet of Gas per Ton of Coal.	Illuminating Power in Candles.	Coke per Ton of Coal used.	Ash in Coke, per Cent.	Sulphur in Coal, per Cent.
Silkstone Nuts . . .	10·800	15·85	12·66 cwt.....	6·0	0·69

NOTE.—The illuminating power of the gas was tested by the standard burner now used in London by the Gas Referees, under the City of London Gas Act, 1868.
Horseferry Road, Westminster, March, 1870. (Signed) F. J. EVANS.
These Nuts are extensively used by various Gas Companies throughout the Kingdom, who bear strong testimony to their value.
APPLICATIONS FOR PRICES, &c., TO BE SENT DIRECT TO THE COLLIERY, AS ABOVE.

THE SILKSTONE & DODWORTH COAL & IRON COMPANY, LIMITED,

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JAMES PATERSON, Esq., Gas Engineer, of the Warrington Gas Company, reported, Aug. 10, 1875:—

"This Coal possesses remarkable qualities as a gas and coking coal, and appears SECOND TO NONE IN THE KINGDOM. It contains the large quantity of 699 lbs. of illuminating matter, and 1498 lbs. of coke to the ton, and produces **12,240** cubic feet of 16·66 candle gas."

The above Company are raising nearly a thousand tons of the Real Old Silkstone Gas Coal per working day.

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THE DERBYSHIRE

SILKSTONE COAL COMPANY, LIMITED,

CAN OFFER A

GAS COAL

Of superior quality, delivered at any station in England and Wales.

Purified gas per ton of coal in cubic feet (average)	**10,775**
Weight of coke in lbs. per ton of coal	**1,465**

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Works: LOCHORE by LOCHGELLY, FIFESHIRE. Office: CUSTOM HOUSE CHAMBERS, LEITH.

This Company request attention to the very superior quality of their Cannel Coals.

1. The following are the practical results given by Dr. Wallace, of Glasgow, of analyses of their Lochore and Capledrae Cannels:—

	Sample worked at Capledrae.		Sample worked at Lochore
Gas per ton of coal, at 60° Fahr. and 30 inches barometric pressure . .	13,095 cubic feet.	..	11,760 cubic feet.
Illuminating power, in standard sperm candles, by union jet consuming 5 cubic feet per hour, at ·5-inch pressure	32·91	..	34·83
Value of 1 cubic foot of gas in grains of sperm	780	..	836
Equivalent of a ton of coal in pounds of sperm candles	1,459	..	1,404
Durability of 1 cubic foot by 5-inch flame	69 minutes.	..	71 minutes.
Gravity of the gas (air = 1000)	596	..	594

Remarks.—This (the sample from Capledrae) is a Cannel Coal of first-class quality, giving 13,000 feet of 33-candle gas. It contains only a minute proportion of sulphur, and the ash is almost quite white. The coke is of rather inferior quality.

Remarks on Sample from Lochore.—This is a Cannel Coal of first-class quality, giving a large yield of very rich gas and a coke of medium quality.

2. The following are the practical results of analyses by Dr. Wallace of the Company's Waverley Cannels:—

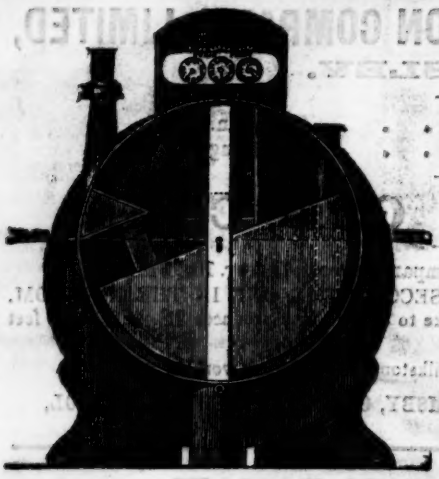
	Capledrae Waverley.		Lochore Waverley.
Gas per ton of coal, at 60° Fahr. and 30 inches barometer	9,120 cubic feet.	..	11,145 cubic feet.
Illuminating power, in standard candles, by union jet consuming 5 cubic feet per hour, at ·5-inch pressure	36·62	..	33·09
Value of 1 cubic foot of gas in grains of sperm	878	..	794
Equivalent of a ton of coal in pounds of sperm candles	1,145	..	1,264
Durability of 1 cubic foot of gas by 5-inch flame	80 minutes.	..	67 minutes.
Gravity of the gas (air = 1000)	677	..	597

Remarks on the Sample of Capledrae Waverley.—This Coal gives fully 9000 feet of gas of 36½ candles, and is admirably adapted for bringing up the quality of gas made from common coal or inferior qualities of cannel. The tests were made at a rather high temperature, this being one of the coals that stand a very high heat without serious diminution of the illuminating power of the gas The coke contains 60 per cent. of ash, and is therefore almost valueless, but the proportion of sulphur is very moderate.

Remarks on the Lochore Waverley.—This is a first-class Cannel Coal, giving 11,000 cubic feet of 33-candle gas. The quantity of sulphur is very minute, and the ash is nearly white. The coke is of inferior quality, but not wholly valueless.

Applications for full Copies of Analyses and Prices may be made to the Company.

OFFICE: CUSTOM HOUSE CHAMBERS, LEITH.



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"Unquestionably the best Water Gas-Meter now in use."—Thos. G. Barlow, C.E.

Over 90,000 in action.

MANUFACTURERS

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GAS-RETORTS, LUMPS, TILES, & FIRE-BRICKS,

OF EVERY DESCRIPTION.

A LARGE ASSORTMENT OF GAS-RETORTS IN STOCK.

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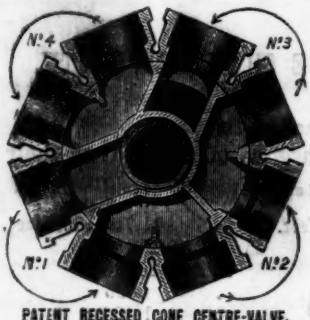

PATENT RECESSED CONE CENTRE-VALVE.
Sectional Plan.

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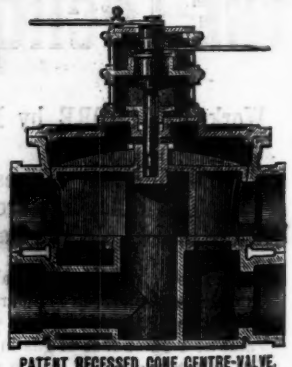
PATENT

RECESSED CONE CENTRE-VALVES,

Constructed on the principle of the ordinary Plug-Cock.

THROUGH-WAY & FOUR-WAY COCKS

Of all descriptions.



PATENT RECESSED CONE CENTRE-VALVE.
Sectional Elevation.

LONDON OFFICE: 106, CANNON STREET.

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PATENTEES and MANUFACTURERS of the ONLY GOOD MERCURIAL GAS REGULATOR

Invite the attention of Gas Companies and the Trade generally to their Improved GAS-METERS, which they warrant equal to any in Quality, Workmanship, and Simplicity of Construction, and the only Meters from which Gas cannot be obtained without being duly registered.

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